GREAT LAKES FORESTRY CENTRE
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Results of forest insect and disease surveys in the ALGONQUIN REGION of Ontario, 1987

CARRIED OUT BY THE GREAT LAKES FORESTRY CENTRE IN COOPERATION WITH THE ONTARIO MINISTRY OF NATURAL RESOURCES

R. J. Sajan and B. E. Smith

Miscellaneous Report No. 74

THE GREAT LAKES FORESTRY CENTRE

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RESULTS OF FOREST INSECT AND DISEASE SURVEYS IN THE ALGONQUIN REGION OF ONTARIO 1987

(FOREST DISTRICTS: PARRY SOUND, BRACEBRIDGE, ALGONQUIN PARK, PEMBROKE, MINDEN AND BANCROFT)

R.J. SAJAN and B.E. SMITH

GREAT LAKES FORESTRY CENTRE

CANADIAN FORESTRY SERVICE

GOVERNMENT OF CANADA

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SURVEY HIGHLIGHTS

This report describes the most important and prevalent biotic and abiotic conditions that were detected during extensive aerial and ground surveys throughout the Algonquin Region of Ontario in 1987.

The area of moderate-to-severe defoliation caused by the forest tent caterpillar increased dramatically from 11,160 ha in 1986 to 473,964 ha in 1987. The majority of damage occurred in the Bracebridge and Parry Sound districts. The area defoliated by the Bruce spanworm increased by approximately 50%, to 233,911 ha, mainly in Bancroft and Minden districts. Increases in population levels of the redheaded pine sawfly and the pine false webworm were also evident. Gypsy moth population levels and defoliation by this insect declined in Bancroft District, where only 111 ha were affected in 1987; however, trace numbers of larvae and egg masses were found at several new locations in Minden District and at one location in Parry Sound District.

During surveys conducted in 88 pine plantations seven plantations were found to be infected with the European race of Scleroderris canker. This brings the regional total to 15 sites on which the European race of the disease has been found since 1985: four in Mayo Township in Bancroft District, four in Macaulay Township in Bracebridge District, and six in McMurrich Township and one in Ryerson Township in Parry Sound District. Heavy frosts in early May caused considerable damage to trees of a wide variety of species, and the drought that occurred throughout much of the growing season resulted in early discoloration and leaf-drop in many hardwoods, especially sugar maple growing on hilltops.

Twenty semipermanent sugar maple plots were established for the purpose of monitoring crown conditions. Two red oak decline plots and six Acid Rain National Early Warning System (ARNEWS) plots were retallied, and a collection of 100 white spruce cones was made at each of two locations in an attempt to determine which pests were affecting seed production. Ten randomly selected white spruce plantations were evaluated as part of continuing surveys of high-value plantations.

In this report, the following categories are used to determine the importance of insects and diseases:

Major Insects/Diseases

capable of causing serious injury to or death of living trees or shrubs

Minor Insects/Diseases

capable of causing sporadic or localized injury but not usually a serious threat to living trees or shrubs.

Other Forest Insects/Diseases (Tables)

These tables provide information on two types of pest:

(1) those that are of minor importance and have not been known to cause serious damage to forest trees,

(2) those that are capable of causing serious damage but, because of low populations or for other reasons, did not cause serious damage in 1987.

The authors would like to express their appreciation to personnel of the various Ontario Ministry of Natural Resources (OMNR) district offices, the OMNR Regional Office, especially the timber staff, and private individuals for their excellent cooperation during the 1987 field season.

R.J. Sajan

B.E. Smith

Frontispiece

Severe defoliation of sugar maple (*Acer saccharum* Marsh.)
by the forest tent caterpillar (*Malacosoma disstria* Hbn.)

An egg mass of the forest tent caterpillar
(the overwintering stage of the life cycle)

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INSECTS

Major Insects

Pine False Webworm, *Acantholyda erythrocephala* (L.)

Population levels and distribution of this introduced pest continued to increase across the southern half of the region. Several red pine (*Pinus resinosa* Ait.) plantations in Minden and Bancroft districts were found infested for the first time this season (Fig. 1).

The highest population levels were recorded in red pine plantations in Carlow, Monteagle and Mayo townships in Bancroft District. In the Boulter area of Carlow Township, where 99% of trees 4.3 m high were infested with an average of more than 100 webmasses per tree, 42% defoliation resulted. In the Maynooth area of Monteagle Township, 94% of red pine trees 2.1 m high had a similar number of webmasses, and were 49% defoliated. In a plantation in the McArthur Mills area of Mayo Township, in which trees were an average of 3.8 m high, 100+ webmasses per tree were noted. Only 20% of the trees were infested, however, and defoliation was estimated at 50%.

In a red pine plantation near Maple Lake, in Stanhope Township in Minden District, 100% of trees 1.4 m high were found infested with an average of 10 webmasses per tree, and defoliation was 70%. Because all of the old foliage had been consumed on approximately 10-15% of the infested trees, the larvae were forced to feed on the current year's foliage. A mortality rate of 2% resulted from this heavy feeding. During the third week of June, staff of the Ontario Ministry of Natural Resources (OMNR), Minden District, hand-sprayed the plantation with the insecticide Sevin at a mixture rate of 5 ml of active ingredient per 1 L of water. During ground surveys conducted several days later no living larvae were detected.

In a 5-ha eastern white pine (*Pinus strobus* L.) seed orchard in Snowdon Township, Minden District, a standard 150-tree evaluation revealed that 51% of the trees 1.6 m high contained an average of three webmasses each. In an attempt to control the pest in the seed orchard, OMNR staff hand-picked and destroyed the webmasses and larvae throughout the orchard.

In all, 13 plantations across the region were surveyed for this pest. The data collected are summarized in Table 1.

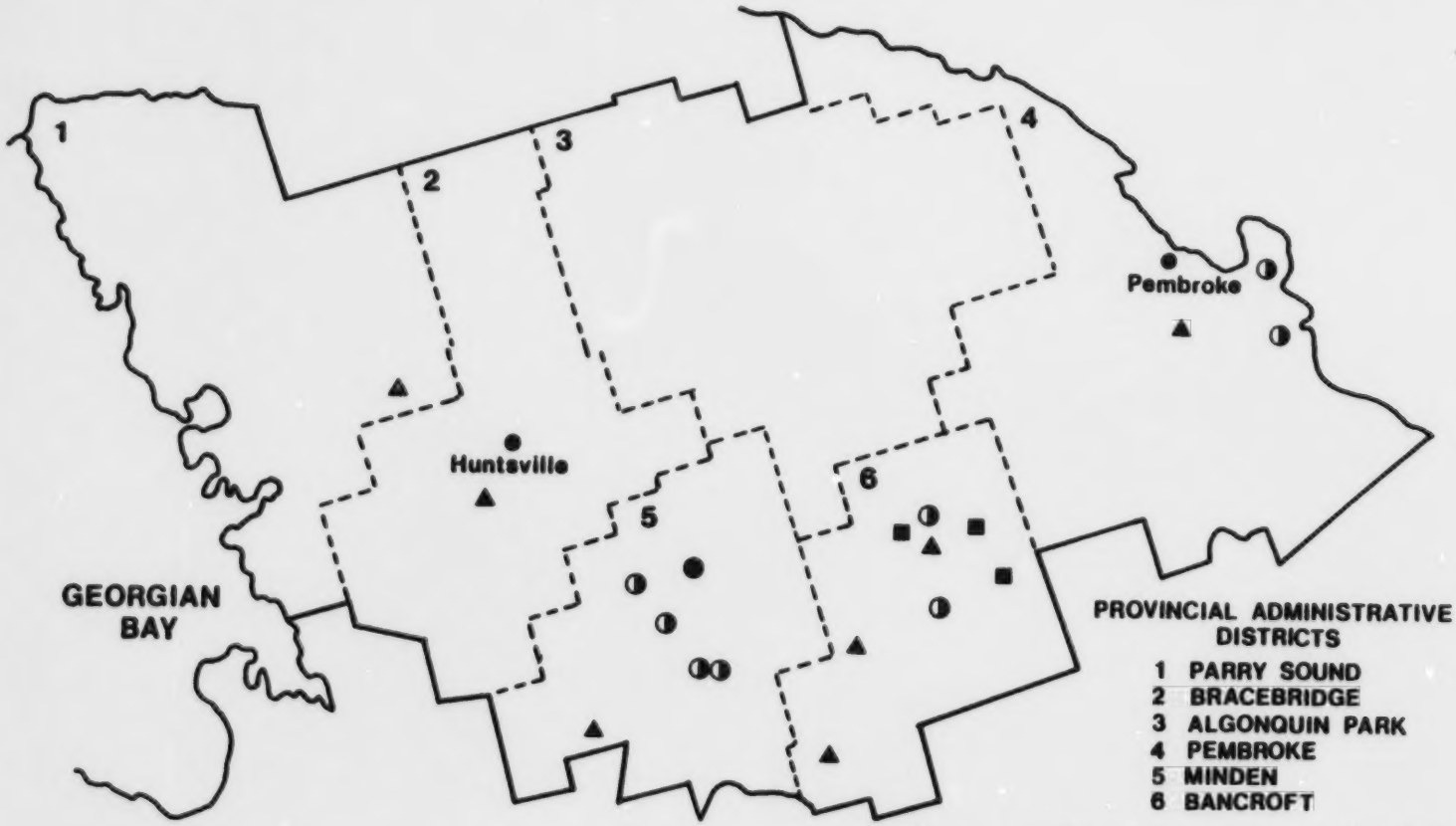


Figure 1. Pine False Webworm (*Acantholyda erythrocephala* [L.])

Table 1. Results of surveys for the pine false webworm in the Algonquin Region (counts based on the examination of 150 randomly selected trees at each location).

Location (Twp)	Host	Tree ht (m)	Total area affected (ha)	Total trees per ha	Trees infested (%)	Avg no. of web-masses per tree	Avg defoliation of infested trees (%)
Bancroft District							
Mayo	rP	3.8	15.0	2,400	20	100+	50
Carlow	rP	4.3	3.5	2,300	99	100+	42
Burleigh	rP	2.0	1.0	2,300	3	15	20
Dungannon	rP	1.6	1.5	2,200	4	2	2
Monteagle	rP	2.1	2.5	2,300	94	100+	49
	rP	0.5	4.0	2,500	4	2	2
	rP	1.8	1.0	2,500	30	10	15
Minden District							
Minden	rP	4.4	3.0	2,100	2	1	1
Stanhope	rP	1.7	3.0	2,200	13	2	1
	rP	1.4	5.0	2,200	100	10	70
Snowdon	wP	1.6	5.0	1,000	51	3	3
	rP	0.5	1.0	2,000	60	1	1
Parry Sound District							
McMurrich	rP	1.5	7.0	2,000	40	3	5

Cedar Leafminer complex, *A. aureoargentella* Brower,
Argyresthia canadensis Free.,
A. thuiella (Pack.),
Coleotechnites thujaella (Kft.)

After four consecutive years of low population levels, an increase has occurred in this complex of insects. Moderate-to-severe damage was observed throughout Pembroke and Bancroft districts and at the extreme southern end of Minden District. These are essentially the same areas that were affected in previous infestations in 1969, 1974 and 1982.

Two areas in Pembroke District had scattered pockets of heavy damage; one was east of the village of Westmeath in Westmeath Township, where 15-m-high roadside trees sustained 40% defoliation, and the other was along Hwy 508 east of the village of Calabogie and along township roads in the northwestern corner of Bagot Township.

Small, scattered pockets of up to 25% defoliation occurred along township roads in the southwestern corner of Faraday Township in Bancroft District. Roadside cedar growing along Hwy 649 north of the town of Bobcaygeon and along Hwy 35 south of the town of Coboconk in Minden

District sustained 10-20% defoliation. Damage throughout these areas was scattered.

At numerous locations throughout the remainder of the above-mentioned districts, defoliation amounted to 5% in 0.5- to 1-ha roadside stands.

Spruce Budworm, *Choristoneura fumiferana* (Clem.)

Across the province there was a pronounced decline in both area and intensity of defoliation caused by the spruce budworm in 1987. A total of 7,189,763 ha of moderate-to-severe defoliation was aerially sketch-mapped during the field season. This was approximately 19% less than last year when the same level of defoliation was mapped over 8,855,687 ha. The largest decline occurred along the eastern portion of the area in which the budworm was reported in 1986, in the Northern, Northeastern and North Central regions. There was a small increase (about 50,000 ha) in area defoliated along the northern edge of the infestation, mainly in Ignace, Sioux Lookout and Red Lake districts in the Northwestern Region (Fig. 2).

The reduction in both defoliation and population levels may have resulted from the heavy frosts that occurred across much of northern Ontario on 22 and 24 May. The most noticeable impact of the frost was seen and recorded in the North Central Region, where damage to new shoots on softwoods often exceeded 75%. The annual egg-mass surveys conducted throughout the known areas of infestation confirmed a marked reduction in population levels, especially in the areas most heavily damaged by the frosts.

In the Algonquin Region, populations remain very low; only three small pockets (each <5 ha in size) at the northern end of Bracebridge District were detected from the air. In Armour Township, light-to-moderate defoliation was detected on scattered, mature white spruce (*Picea glauca* [Moench] Voss) south of Pickerel Lake and on white spruce and balsam fir (*Abies balsamea* [L.] Mill.) along the northeastern shore of the same lake. A similar pocket of defoliated fir was found to the north along Smith Creek in Joly Township (Fig. 3).

At six predetermined locations, three nonsaturating Multi-pher sex pheromone traps were set out to monitor adult populations. Pheromone traps are used to determine if a particular pest is present in a given area, and the trapping results can be used to forecast population levels. The traps were in place for approximately one month and positive counts were recorded in Stratton and White townships in Algonquin Park District, and in Alice Township in Pembroke District. Negative counts were recorded in Bethune Township in Bracebridge District, Hindon Township in Minden District, and Spence Township in Parry Sound District.

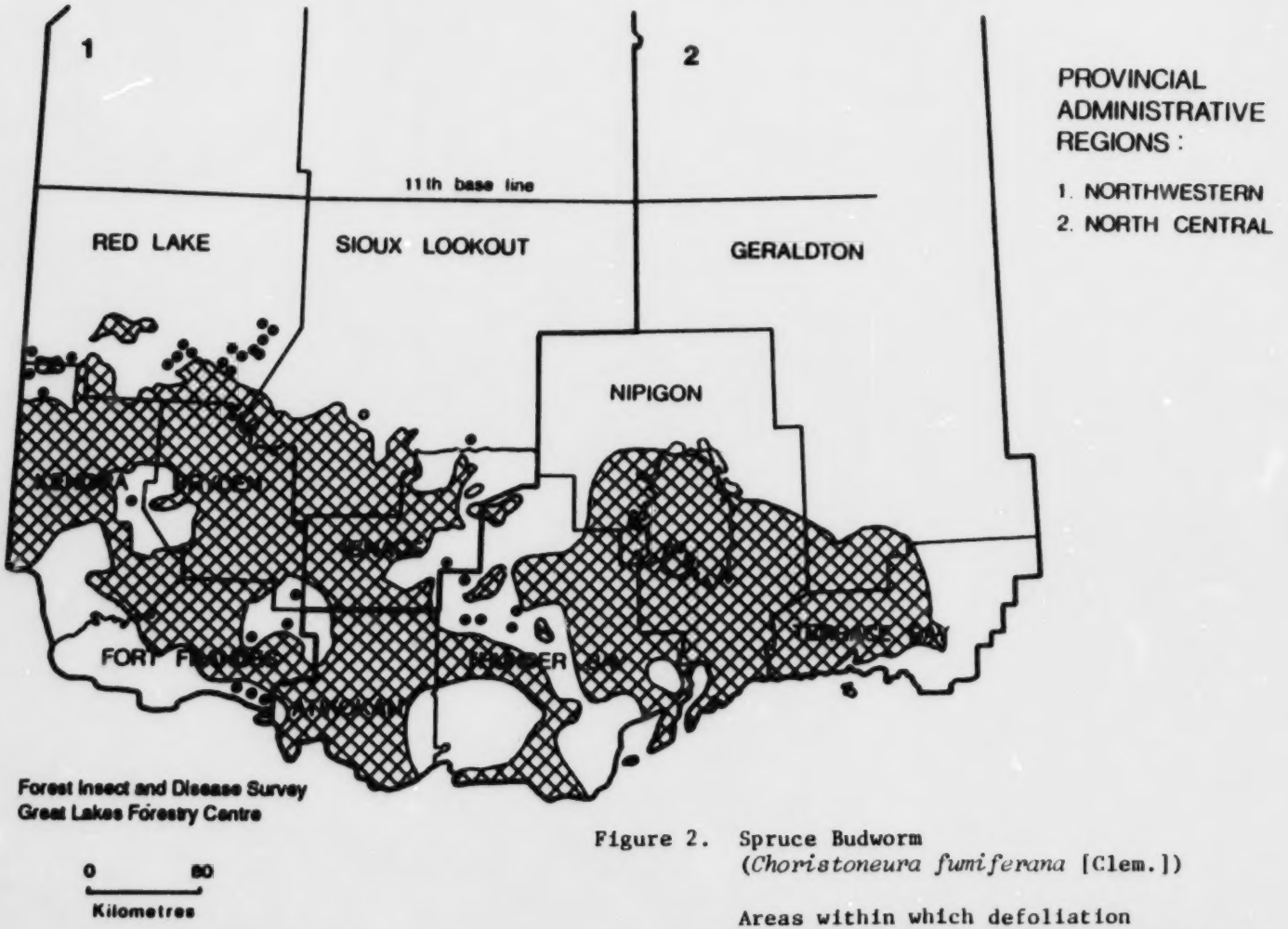


Figure 2. Spruce Budworm
(*Choristoneura fumiferana* [Clem.])

Areas within which defoliation
occurred in 1987 in Northwestern Ontario

Moderate-to-severe ..... ▨ or ●

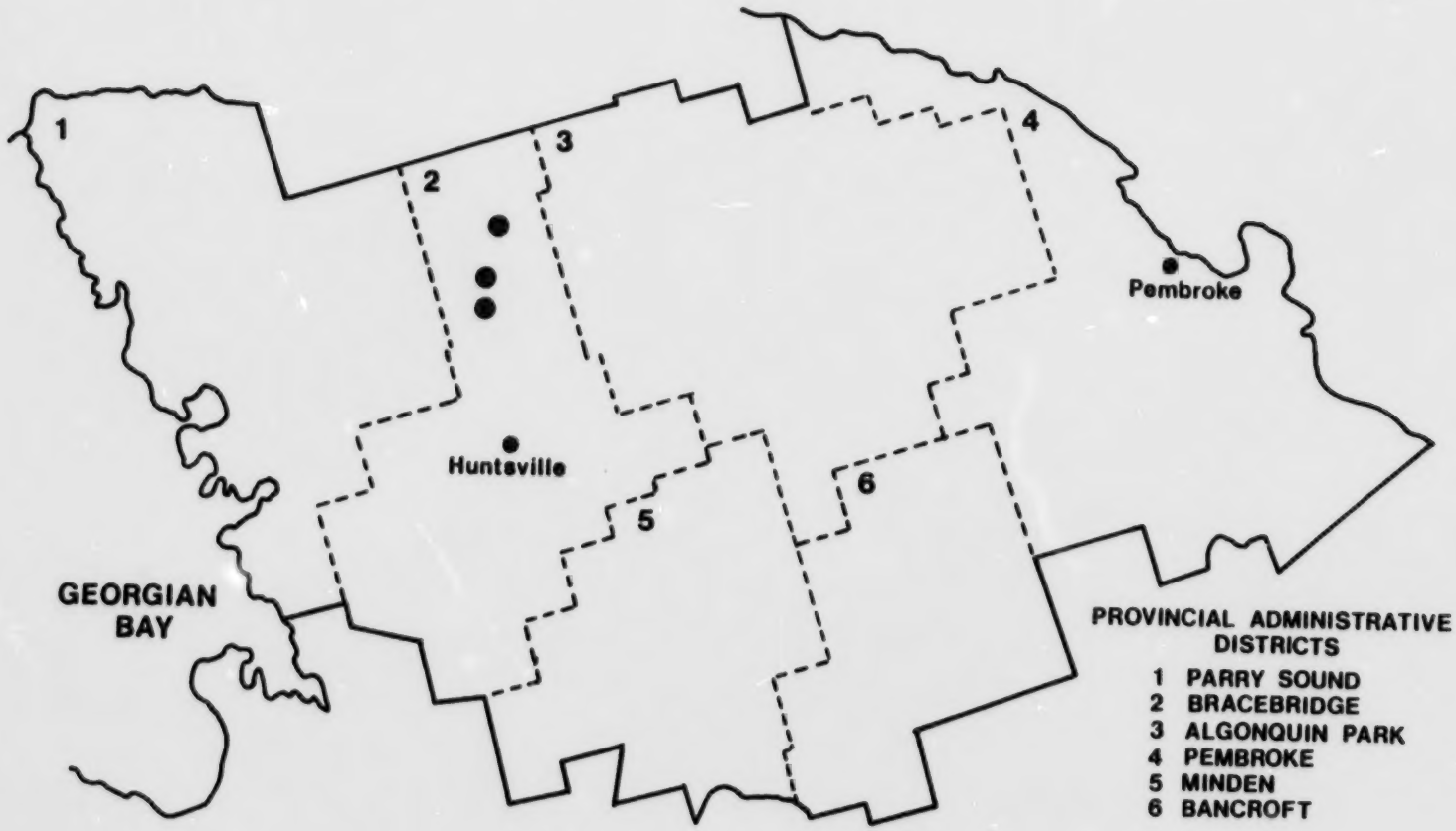


Figure 3. Spruce Budworm (*Choristoneura fumiferana* [Clem.])

Areas within which defoliation occurred in 1987 in the Algonquin Region

Light-to-moderate .....●

To forecast possible population levels for the next year, six branches from the mid-to-upper crowns of dominant or codominant spruce or fir were sampled. The total number of spruce budworm egg masses found in the sample at each location is used to predict defoliation that could occur at the sample point in the next season. To this end, eight locations in the region were sampled, two in each of Algonquin Park, Parry Sound and Pembroke districts, and one in each of Bracebridge and Minden districts. Negative counts, indicating that no defoliation will occur, were recorded at all of the sample points except that in Hindon Township in Minden District. The number of egg masses recovered at this location indicates that light defoliation (<25%) may occur in 1988.

Jack Pine Budworm, *Choristoneura pinus pinus* Free.

There has been a complete collapse of populations of this destructive pest of jack pine (*Pinus banksiana* Lamb.) in Parry Sound District, where defoliation has occurred since 1982 and tree mortality since 1983. The infestation peaked in 1985 when some 54,034 ha were severely defoliated. The collapse was forecast in 1986 on the basis of an egg-mass survey, which is conducted annually to predict population levels.

Aerial surveys conducted in early July 1987 failed to reveal any evidence of damage to jack pine caused by the feeding of this pest. The egg-mass survey was reduced from 13 locations in 1986 to four in 1987, all within Parry Sound District. At each location, six 61-cm-long branch tips were examined for egg masses. Only a single egg mass was found, at the sample point along Highway 69 at the Magnetawan River in Wallbridge Township; hence, light defoliation is forecast for this area in 1988.

Fall Webworm, *Hyphantria cunea* (Dru.)

There was a noticeable decrease in population levels and distribution of this insect across the entire region.

Trace numbers of webmasses were recorded on widely scattered roadside white elm (*Ulmus americana* L.) in McNab Township in Pembroke District. Single nests were observed causing less than 2% defoliation in roadside pockets of ash (*Fraxinus* spp.) < 0.5 ha in size in Conger and Gibson townships, Parry Sound District. Similar levels of defoliation were found along the Kawartha Lakes in the Burleigh Falls and Buckhorn areas of Minden District, along bush roads in Edgar Township in Algonquin Park District, and along county roads in Carlow Township in Bancroft District.

Gypsy Moth, *Lymantria dispar* (L.)

There was a marked decrease of approximately 70% in the area of moderate-to-severe defoliation caused by the gypsy moth in the region in 1987. In the previous year, an estimated 385 ha were heavily infested; only 111 ha were heavily infested in 1987. The largest reduction occurred in Pembroke District, where there was a complete collapse within the 221 ha infested in 1986. In Bancroft District, where the remainder of the current infestation exists, a reduction also occurred, from 164 ha in 1986 to 111 ha in 1987. This marked decline is a direct result of the major spray program that has been conducted by OMNR against this pest in the last two years. In 1987, 5,083 ha of crown land were treated in Pembroke District and 389 ha in Bancroft District. The areas were sprayed with multiple applications of the biological insecticide *Bacillus thuringiensis (B.t.)*.

In 1987, moderate-to-severe defoliation occurred in the extreme southeastern corner of Bancroft District. The total area of 111 ha consists of 12 pockets scattered across Methuen Township, the largest of which is 33 ha and is on the north side of Oak Lake. Two pockets, 28 ha and 14 ha in size, were detected at the southeastern end of South Lake, and a 21-ha pocket was located at the western end of Long Lake. Two pockets, 6 and 8 ha in size, were mapped east and north of Methuen Lake as were several smaller pockets, 3-4 ha in size, along the shores of Kasshabog Lake (Fig. 4). Several pockets of light-to-moderate defoliation, all 3-5 ha in size, were also found along the shores of Kasshabog Lake.

Elsewhere in the region, trace numbers of caterpillars were collected at Petroglyphs Provincial Park in Bancroft District, and at Bonnechere and Carson Lake provincial parks and the Petawawa National Forestry Institute (PNFI) in Pembroke District. Trace numbers were also found at Mississagua Lake in Harvey Township, Gull Lake in Lutterworth Township, and Mountain Lake in Minden Township, all in Minden District.

Trace numbers of egg masses were found at Petroglyphs Provincial Park in Bancroft District, at the Canadian Armed Forces (CAF) Base at Petawawa and at PNFI in Pembroke District. Similar numbers were found at Haliburton Lake in Harburn Township, in a maple *(Acer* spp.) bush along Haliburton County Road 519 in Guilford Township, Minden District, and in a red oak *(Quercus rubra* L.) stand in Killbear Provincial Park, Parry Sound District (Fig. 5).

In cooperation with staff of the Provincial Parks Branch of OMNR, the burlap and pheromone trapping program was conducted once again at 22 campgrounds. The burlap traps were set up and checked daily by park staff from late May to early July. The burlap traps were then removed and two pheromone traps were set out at each park, one in the campground, the other at the main entrance to the park.

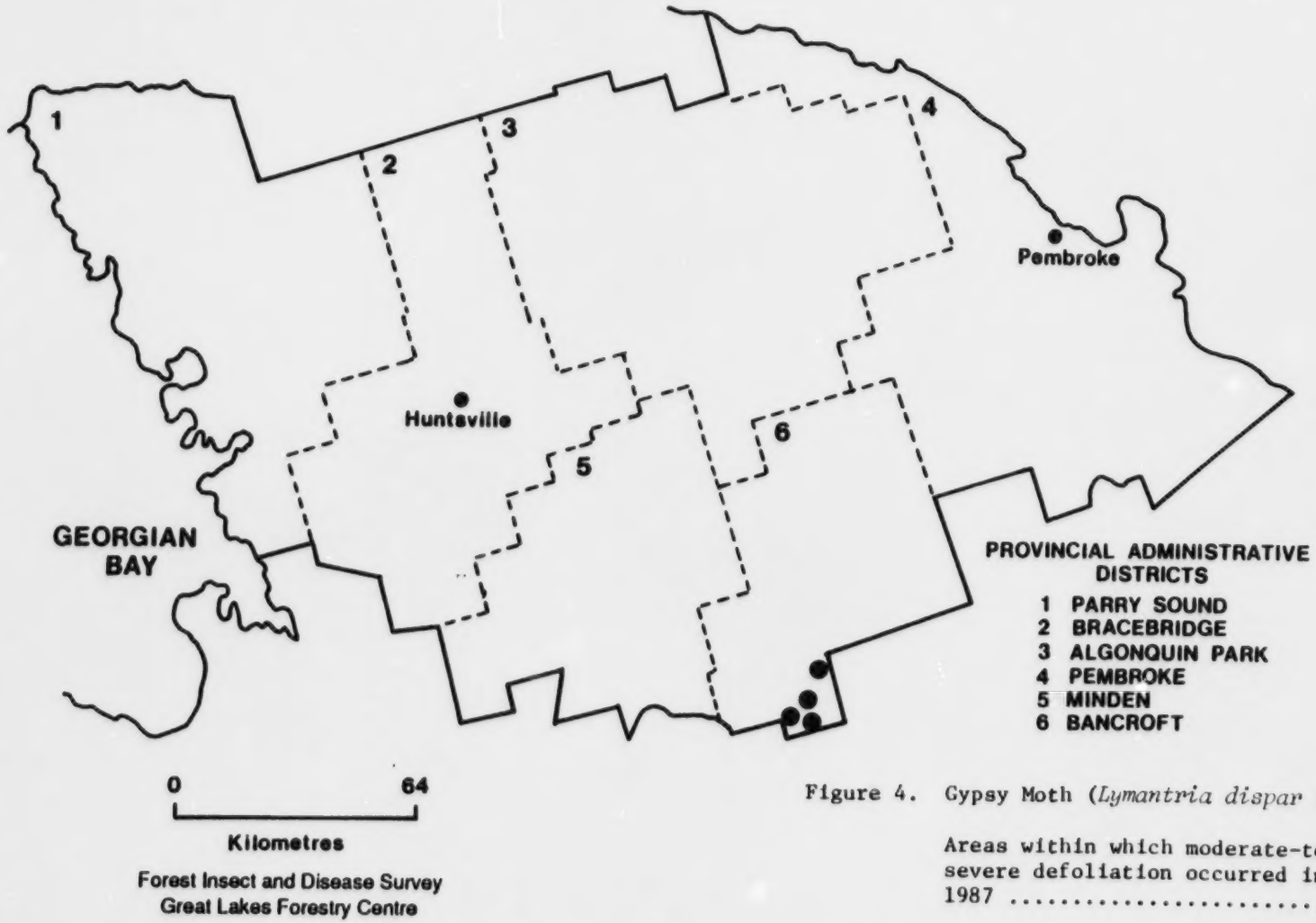


Figure 4. Gypsy Moth (*Lymantria dispar* [L.])

Areas within which moderate-to-severe defoliation occurred in 1987 .....●

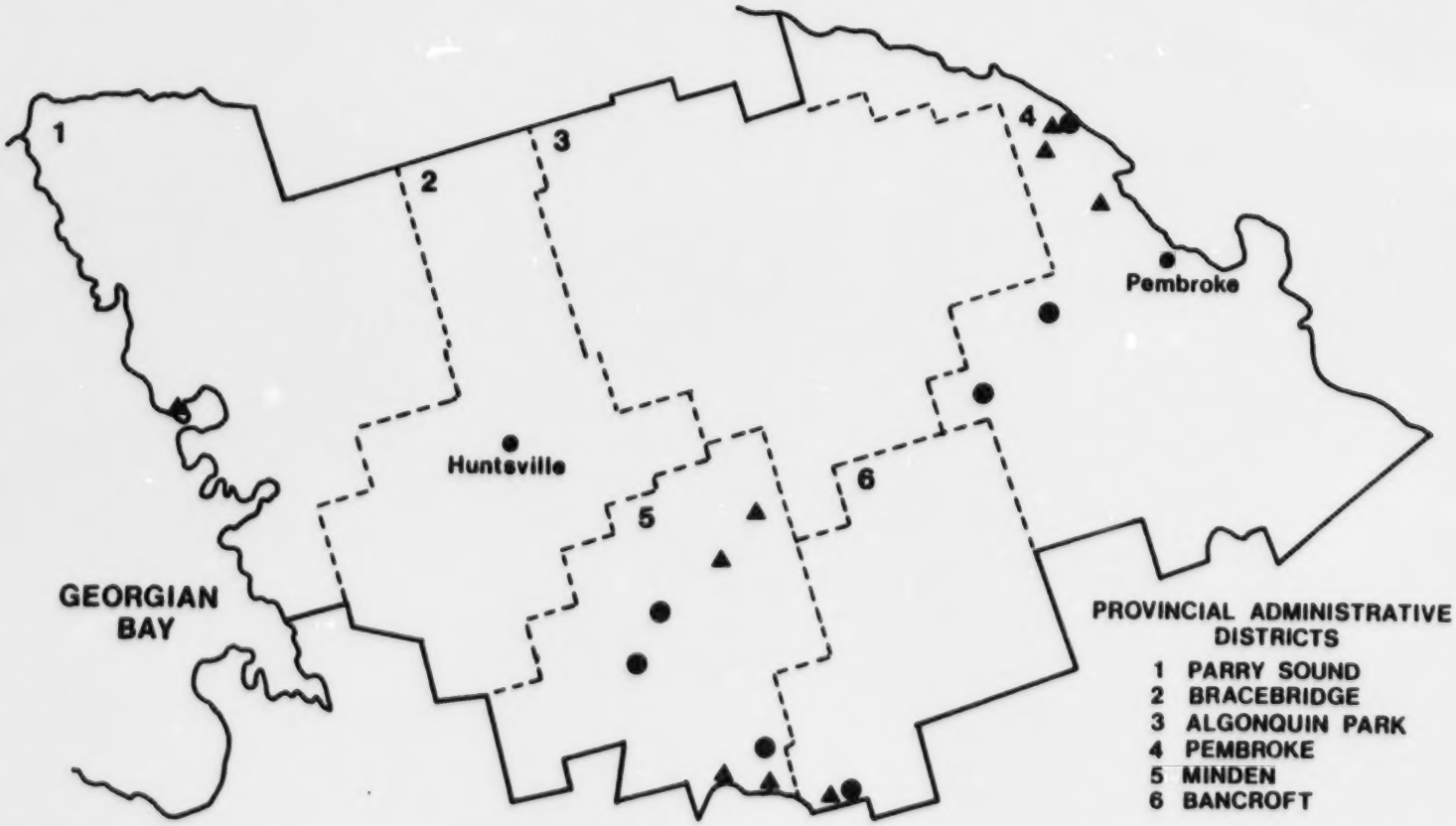


Figure 5. Gypsy Moth (*Lymantria dispar* [L.])

Areas within which trace numbers of larvae were collected in 1987 ....●

Areas within which trace numbers of egg masses were collected in 1987 ...▲

Larvae have been recovered from the burlap traps since 1985 at Bonnechere Provincial Park and in 1987 they were recovered for the first time at Carson Lake Provincial Park in Pembroke District. In 1986 and 1987 they were recovered at Petroglyphs Provincial Park in Bancroft District. The number of male moths trapped yearly in the pheromone traps has steadily increased at the majority of the parks. When the program began in 1984 the regional average was 1.4 male moths per trap; in 1987 an average of 14.1 male moths was trapped. These data are summarized in Table 2.

Pheromone traps were set out during the same period at two additional locations in Pembroke District, 10 at CAF Base Petawawa and four at PNFI. Only three of the 10 traps, containing a total of 59 male moths, were recovered from the CAF Base. Two out of four traps, containing a total of 36 male moths, were recovered at PNFI.

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

There was a major increase in the area of defoliation caused by this hardwood pest across the western half of the region. In all, 473,964 ha were moderately to severely defoliated in 1987, in comparison with only 11,160 ha in 1986. The largest area defoliated (370,595 ha) extended from the southern end of Bracebridge and Parry Sound districts, northward through much of Parry Sound District. A large pocket covering 36,890 ha occurred in the central part of Minden District, and another area of approximately 27,747 ha was detected across the southern ends of Minden and Bancroft districts. Numerous other pockets, varying in size from 50 ha to 7,600 ha, were detected in the immediate vicinity of these larger infestations (Fig. 6). The total areas defoliated, by district, were as follows: Parry Sound - 241,399 ha, Bracebridge - 150,104 ha, Minden - 53,653 ha, Bancroft - 28,628 ha, and Pembroke - 180 ha.

Small numbers of caterpillars could be found in virtually every hardwood stand between the pockets of heavy defoliation in the western portion of the region. Similar numbers were encountered along Hwy 508 near Springtown in Bagot Township, along Hwy 62 at Round Lake in Richard Township, and within the town of Deep River in Buchanan Township in Pembroke District.

Two of the most important natural control agents of this pest are the parasitic fly *Sarcophaga aldrichi* Park. and a nuclear polyhedrosis virus, both of which attack the insect during the pupal stage. A special survey was conducted to determine if these natural controls were present in the current populations and, if so, what level of pupal mortality occurred as a result. At five locations 100 randomly selected cocoons were dissected and the condition of the pupae was determined. An average of 26% of the pupae had been killed by the parasitic fly and 1% by a polyhedrosis virus. These data are presented in Table 3.

Table 2. Results of larval burlap trapping and adult pheromone trapping of gypsy moth at 22 campgrounds in Algonquin Region (counts based on 10 burlap traps and two pheromone traps set out at each location).

Location (Park)	Burlap trapping: positive (+) or negative (-) trapping of larvae				Pheromone trapping: Total number of male moths trapped			
	1984	1985	1986	1987	1984	1985	1986	1987
Algonquin Park District								
Driftwood	-	-	-	-	0[b]	24	17[b]	33
Algonquin Park								
Kearny Lake	-	-	-	-	0[b]	0[b]	2	12
Pog Lake	-	-	-	-	0[b]	0[b]	15	22
Lake of Two Rivers	-	-	-	-	1[b]	0	1[b]	9[b]
Mew Lake	-	-	-	-	1	0	1[b]	14
Tea Lake	-	-	-	-	0[b]	1	3[b]	26
Coon Lake	-	-	-	-	2[b]	0[b]	19	35
Rock Lake	-	-	-	-	1[b]	1	15	30
Whitefish Lake	-	-	-	-	0[b]	0	3[b]	35
Opeongo Lake	-	-	-	-	0[b]	0	18	-[b]
Canisby	-	-	-	-	0[b]	0	3	33
Bancroft District								
Lake St. Peter	-	-	-	-	8[b]	10	38	44
Petroglyphs	-	-	+	+	13	41	22[b]	15[b]
Silent Lake	-	-	-	-	7	13	41	31
Bracebridge District								
Arrowhead	-	-	-	-	0	0[b]	19	23
Mikisew	-	-	-	-	0	0	18	1[b]
Parry Sound District								
Grundy Lake	-	-	-	-	1	0	24	9
Killbear	-	-	-	-	1	2	37	29[b]
Oastler Lake	-	-	-	-	0	1	14	23[b]
Sturgeon Bay	a	-	-	-	a	0	19	18

(cont'd)

Table 2. Results of larval burlap trapping and adult pheromone trapping of gypsy moth at 22 campgrounds in Algonquin Region (counts based on 10 burlap traps and two pheromone traps set out at each location) (concl.).

Location (Park)	Burlap trapping: positive (+) or negative (-) trapping of larvae				Pheromone trapping: Total number of male moths trapped			
	1984	1985	1986	1987	1984	1985	1986	1987
Pembroke District								
Bonnechere	-	+	+	+	2	39	22[b]	22[b]
Carson Lake	-	-	-	+	4[b]	21[b]	40	43

[a] no trapping at campground in 1984

[b] one pheromone trap missing at each location

[c] two pheromone traps missing at each location

Table 3. Results of a forest tent caterpillar cocoon dissection at five locations in Algonquin Region (counts based on the examination of 100 randomly selected pupal cases at each location).

Location (Twp)	Parasitized (%)	Diseased or unknown (%)	Adult emergence (%)
Bancroft District			
Anstruther	30	0	70
Bracebridge			
Cardwell	28	0	72
Minden District			
Lutterworth	22	2	76
Minden	26	1	73
Parry Sound District			
Christie	23	2	75

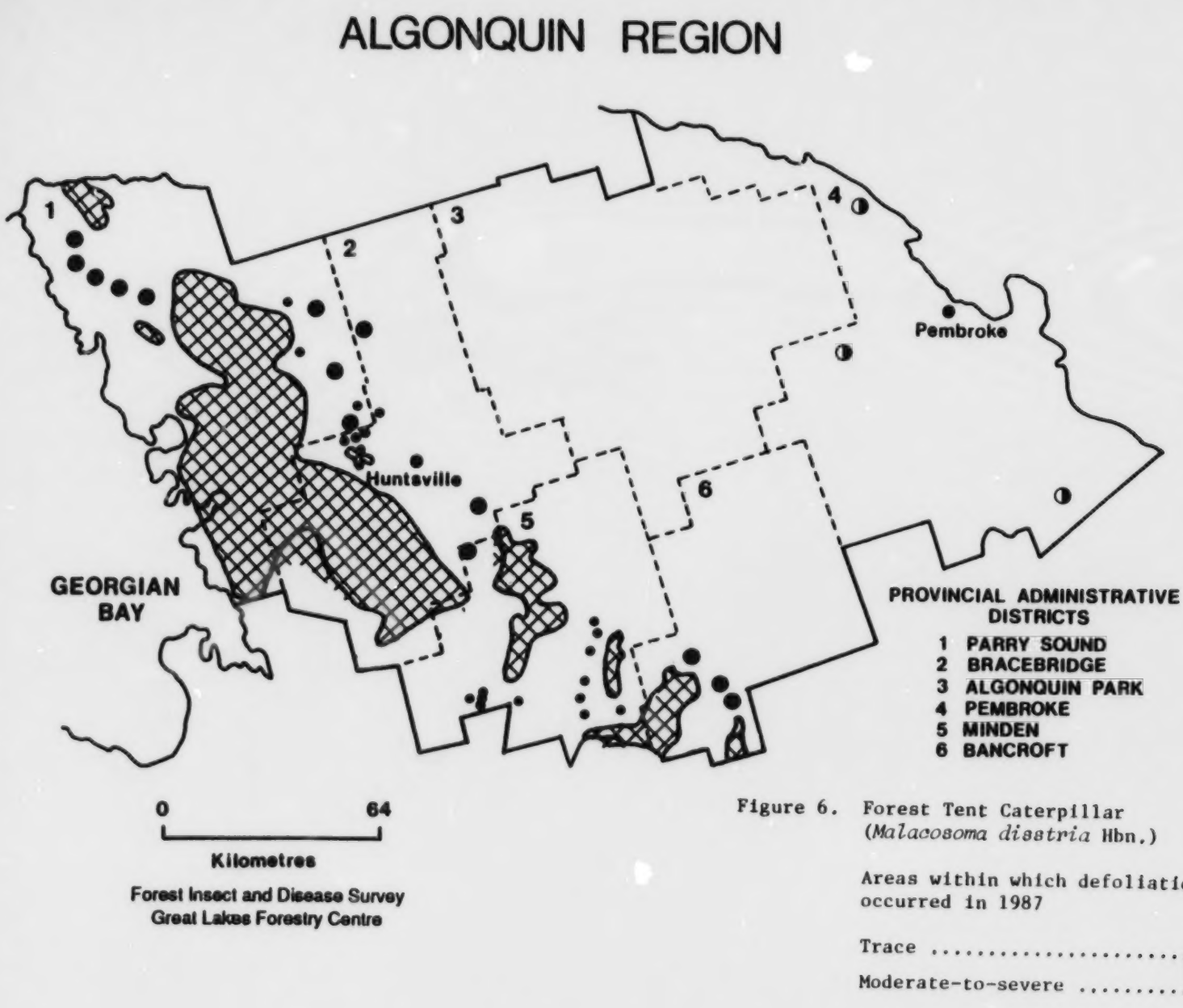


Figure 6. Forest Tent Caterpillar (*Malacosoma disstria* Hbn.)

Areas within which defoliation occurred in 1987

Trace .....

Moderate-to-severe ..... or

An egg-band survey was conducted at 20 locations to determine what defoliation levels may be expected in 1988. The counts were made along the outer edges of known pockets of defoliation, and at all but three of the locations severe defoliation is expected next season. The entire list of locations sampled and forecasts for 1988 are presented in Table 4. In 1988, many of the small, scattered pockets that occurred along the edges of the larger defoliated areas will probably coalesce and may even be engulfed by the much larger infestations. This may happen throughout much of Minden and Parry Sound districts and at the southern end of Bancroft District. There is an extremely large infestation immediately north of the region in the North Bay-Temagami area of the Northeastern Region; it covers 877,414 ha. This infestation may continue to move southward as it has in the past two years and infest the north side of Algonquin Park District.

Twig and branch mortality was detected in red oak and bur oak (*Quercus macrocarpa* Michx.) stands in Gibson and Freeman townships in Parry Sound District, in Macaulay and Franklin townships in Bracebridge District, and in Lutterworth and Minden townships in Minden District. Damage in the crowns ranged from 5 to 50%, with the occasional whole tree dying. This was caused by the combination of frost destroying the original flush of leaves in the early spring, and the forest tent caterpillar consuming all of the new leaves three to four weeks later when the adventitious buds had flushed. As a result, the twigs died.

Additional information about this oak damage can be found in the section on Abiotic Damage, under Frost, and in the section on Diebacks and Declines, under Red Oak Decline.

Balsam Fir Sawfly, *Neodiprion abietis* complex

There was a decrease in the population levels of this insect in 1987. A total of 590 ha was defoliated this season, in comparison with 1,300 ha in 1986 (Fig. 7).

The largest single area of balsam fir defoliation consisted of 200 ha, with defoliation levels ranging up to 25% in mixed stands along Hwy 17 in Stafford Township, just south of the town of Pembroke in Pembroke District. Defoliation levels of 30% occurred on widely scattered roadside trees in McNab Township, Pembroke District. Small pockets of damage with up to 20% defoliation were observed in Bagot, Alice, Horton, and Raglan townships in Pembroke District, and in Limerick and Wicklow townships in Bancroft District.

Table 4. Forest tent caterpillar egg-band counts at 20 locations in Algonquin Region.

Location (Twp)	Host	Avg DBH (cm)	No. of trees examined	Avg no. of egg bands per tree	Infestation forecasts for 1988[a]
Algonquin Park District					
Finlayson	sM	15.0	3	1	L
Bancroft District					
Anstruther	tA	15.0	1	35	S
McClure	tA	16.0	3	0	N
Bracebridge District					
Macaulay	rO	21.5	1	96	S
Wood	lA	16.0	1	42	S
Ridout	sM	12.5	1	10	S
Oakley	tA	13.0	1	42	S
Watt	sM	14.0	1	127	S
Cardwell	sM	13.5	1	42	S
Minden District					
Harvey	sM	14.0	1	32	S
Laxton	sM	13.0	1	19	S
Lutterworth	rO	11.0	1	41	S
Hindon	tA	12.0	1	23	S
Parry Sound District					
Gibson	bO	10.5	1	63	S
Freeman	tA	10.0	1	15	S
Conger	sM	17.5	1	72	S
Mowat	sM	14.0	1	1	L
Henvey	tA	14.0	1	25	S
Christie	tA	14.0	1	32	S
East Burpee	tA	12.5	1	39	S

[a] N = nil, L = light, M = moderate, S = severe

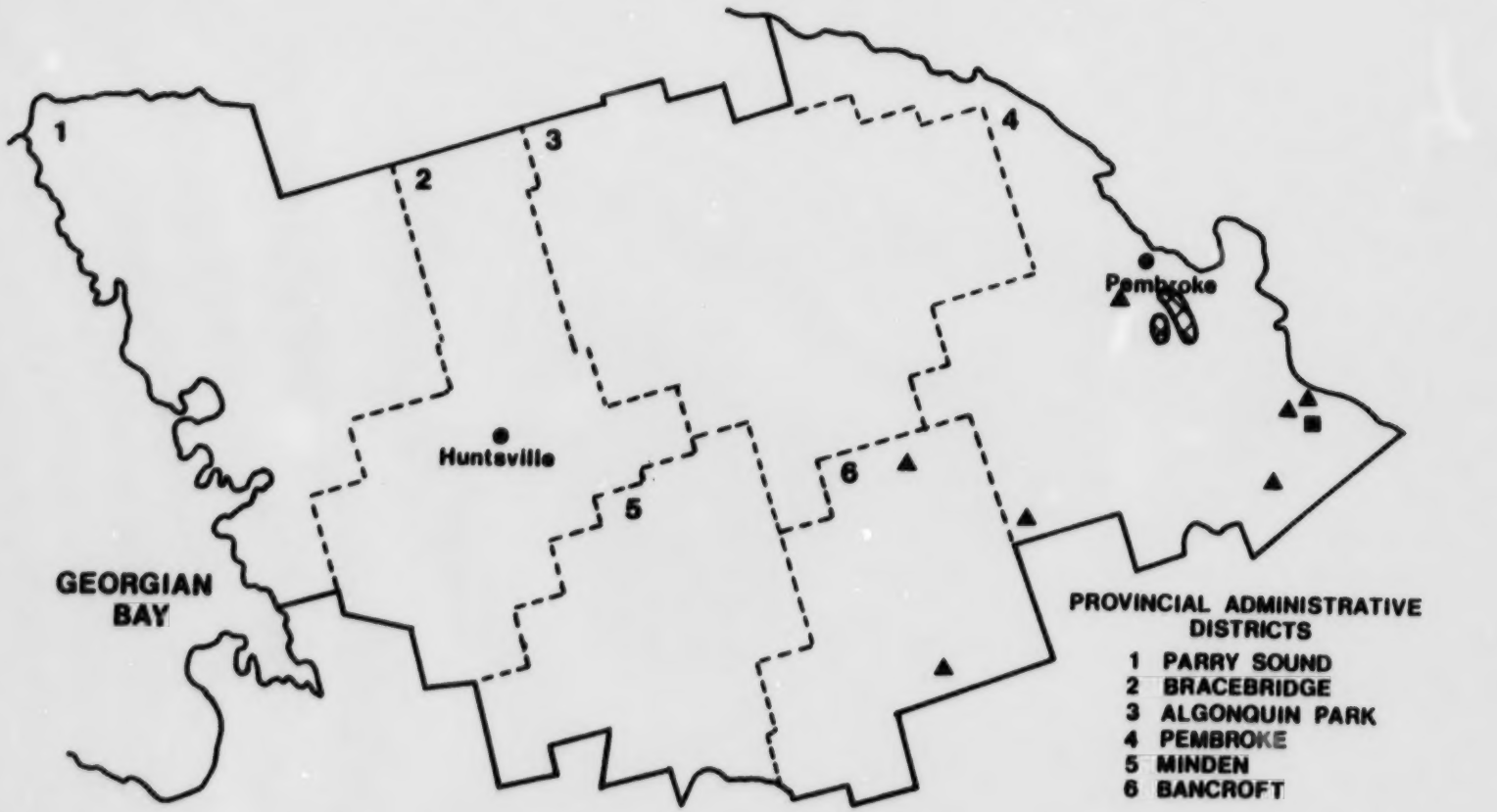


Figure 7. Balsam Fir Sawfly (*Neodiprion abietis* complex)

Areas within which defoliation occurred in 1987

Light ..... ▲

Moderate ..... ■ or ⊠

Redheaded Pine Sawfly, *Neodiprion lecontei* (Fitch)

Population levels of this pine sawfly continued to increase across the region. The frequency of plantations attacked was highest in Bancroft, Parry Sound and Pembroke districts, but damage was found in all districts. In each of the 22 red pine plantations checked, a minimum of 150 trees was randomly selected and evaluated (Fig. 8). On average, 10% of the trees were infested, each with an average of 1.5 colonies, which caused 22.2% defoliation. The heaviest damage occurred in Jones Township, Pembroke District, where 10% of the trees 1.5 m high in a 0.5-ha plantation sustained 75% defoliation. The results of this survey are presented in Table 5.

In an effort to reduce damage caused in plantations by this sawfly, OMNR staff applied the Lecontvirus to a total of 26 plantations in the region. The virus was hand-sprayed at a standard application rate of 5×10^9 polyhedral inclusion bodies (PIBs) per hectare for first- and second-instar larvae, and at 1×10^{10} PIBs per hectare for later-instar larvae. In Parry Sound District, 47 plantations were treated, 15 (totaling 200 ha) with Lecontvirus and 32 (totaling 460 ha) with the chemical insecticide Malathion 50% EC at the standard application rate of 35.5 ml of active ingredient per 11.23 L of water per hectare. In Bracebridge District, eight plantations, totaling 47 ha, were treated at the above-mentioned application rate, also with Malathion 50% EC. In Bancroft District nine plantations, totaling 50 ha, were treated with the Lecontvirus and two plantations, totaling 8 ha, were treated with Malathion 50% EC. In Pembroke District a 2-ha plantation was hand-sprayed with the Lecontvirus and three plantations, totaling 6 ha, were treated with Malathion 50% EC.

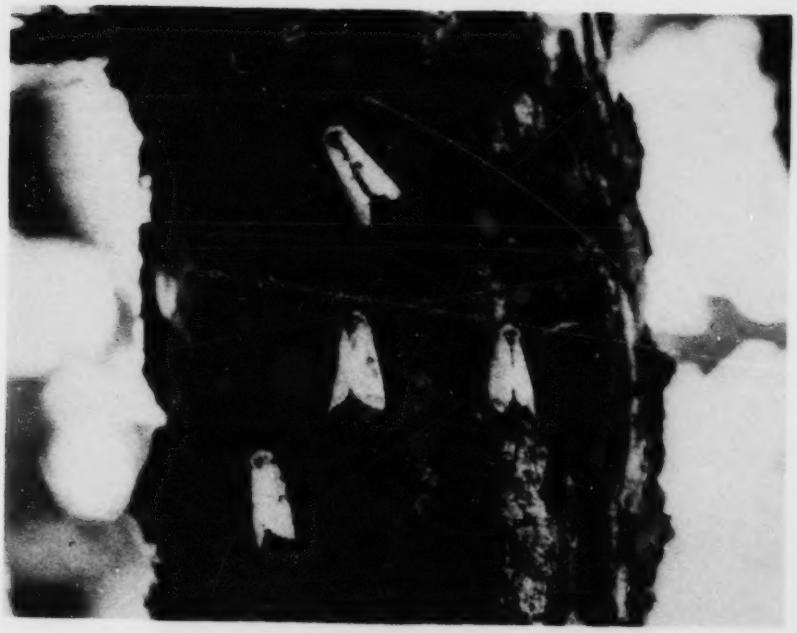
Jack Pine Sawfly, *Neodiprion pratti paradoxicus* Ross

There was a marked decline in populations of this sawfly and in the damage it caused in 1987. Only small, scattered pockets of defoliation remain in the major areas infested in 1986. The largest area, totaling approximately 900 ha, was in small, relatively pure pockets of jack pine across Rolph, Head and Maria townships in Pembroke District (Fig. 9). Up to 25% defoliation was recorded there.

Three small, isolated stands were heavily damaged. The first was in Lyndoch Township, Pembroke District, where a 10-m-tall fencerow sustained 90% defoliation; the second was in a 0.2-ha plot in Herschel Township, Bancroft District, where 12-m-tall trees were 75% defoliated; and the third was in 5-m-tall roadside trees in Somerville Township, Minden District, where 70% defoliation was recorded.

Small, scattered stands that ranged in size from 0.5 to 15 ha were up to 20% defoliated in Radcliffe, Richard, Sherwood, and North Algona townships in Pembroke District. Trace populations caused <1% defoliation in a jack pine plantation in Wood Township, Bracebridge District.

A colony of the redheaded pine sawfly (*Neodiprion lecontei* [Fitch]) defoliating a branch of a red pine (*Pinus resinosa* Ait.)



Adult female gypsy moth (*Lymantria dispar* [L.] laying egg masses on the main stem of a harwood tree

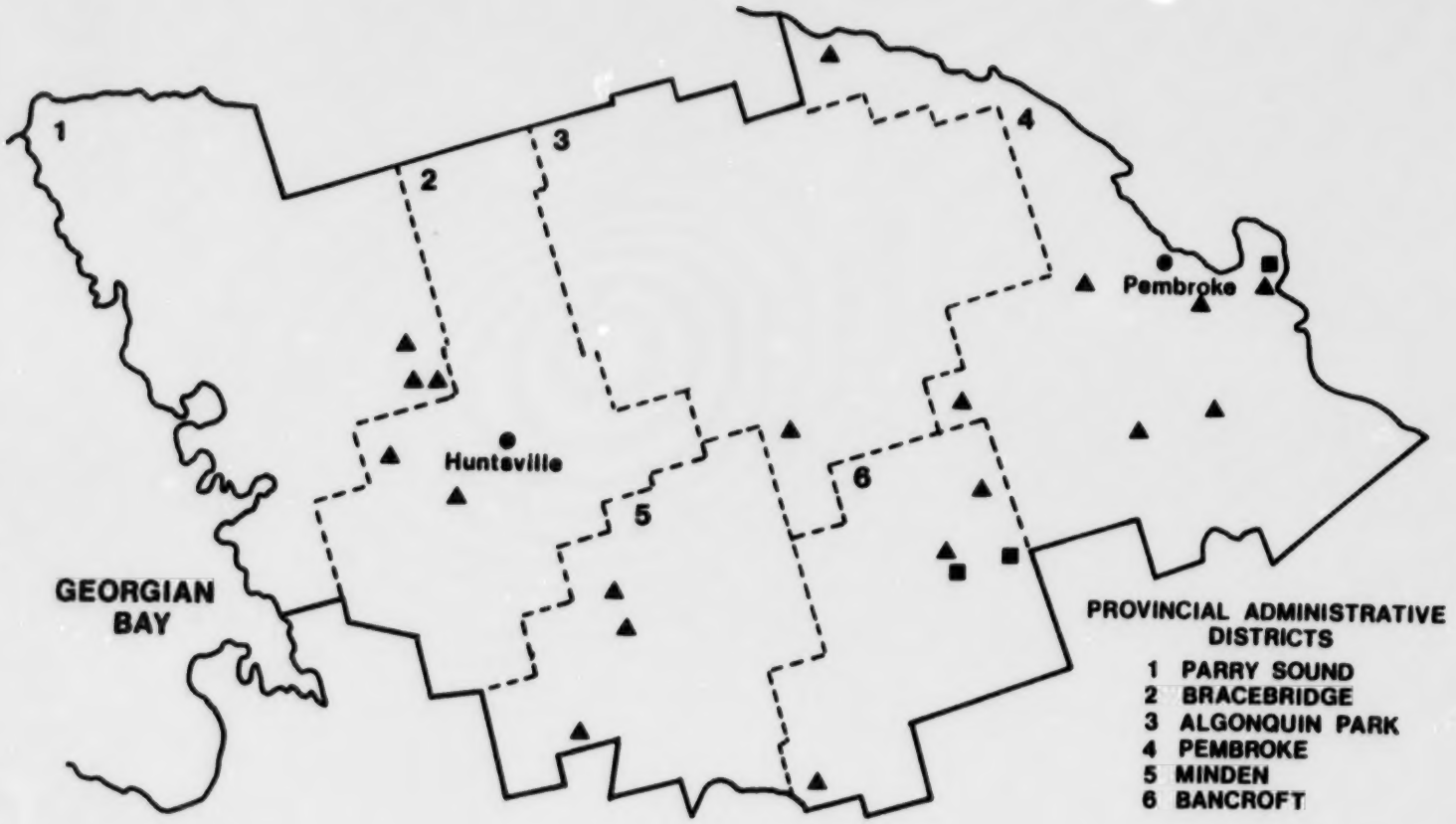


Figure 8. Redheaded Pine Sawfly
(*Neodiprion lecontei* [Fitch])

Areas within which various population levels were recorded in 1987

Light ..... ▲

Moderate ..... ■

Table 5. Damage caused by the redheaded pine sawfly at 22 locations in Algonquin Region in 1987 (counts based on the examination of 150 red pine trees at each location).

Location (Twp)	Avg ht of tree (m)	Total area affected (ha)	No. of trees per ha	Trees infested (%)	Avg no. of colonies per tree	Avg defoliation of infested trees (%)
Algonquin Park District						
Airy	2.0	0.5	2,300	1	1	60
Bancroft District						
Burleigh	2.0	1.0	2,300	8	1	20
Monteagle	0.5	4.0	2,500	1	1	30
Carlow	3.5	1.0	2,500	2	1	10
Dungannon	1.6	1.5	2,200	43	1	25
Mayo	2.9	3.0	2,000	34	3	9
Bracebridge District						
Macaulay	2.5	3.0	2,100	2	1	15
Cardwell	4.0	2.0	2,000	2	1	20
Minden District						
Laxton	2.9	4.0	1,800	9	1	10
Stanhope	1.0	4.0	2,200	12	1	20
Minden	3.6	3.0	2,100	2	1	10
Parry Sound District						
McMurrich	1.5	10.0	2,000	2	1	20
	2.2	4.0	2,200	8	1	20
Ryerson	2.2	3.0	1,900	6	1	15
Pembroke District						
Fraser	0.8	0.5	2,500	1	1	60
Westmeath	4.5	2.0	2,300	2	1	3
	1.6	2.0	2,500	58	2	17
Stafford	1.5	1.5	2,300	2	1	20
Jones	1.5	0.5	2,000	10	4	75
Head	1.5	4.0	2,100	1	1	1
Grattan	2.0	3.0	1,800	1	1	20
Sebastopol	1.4	2.0	2,500	11	3	9

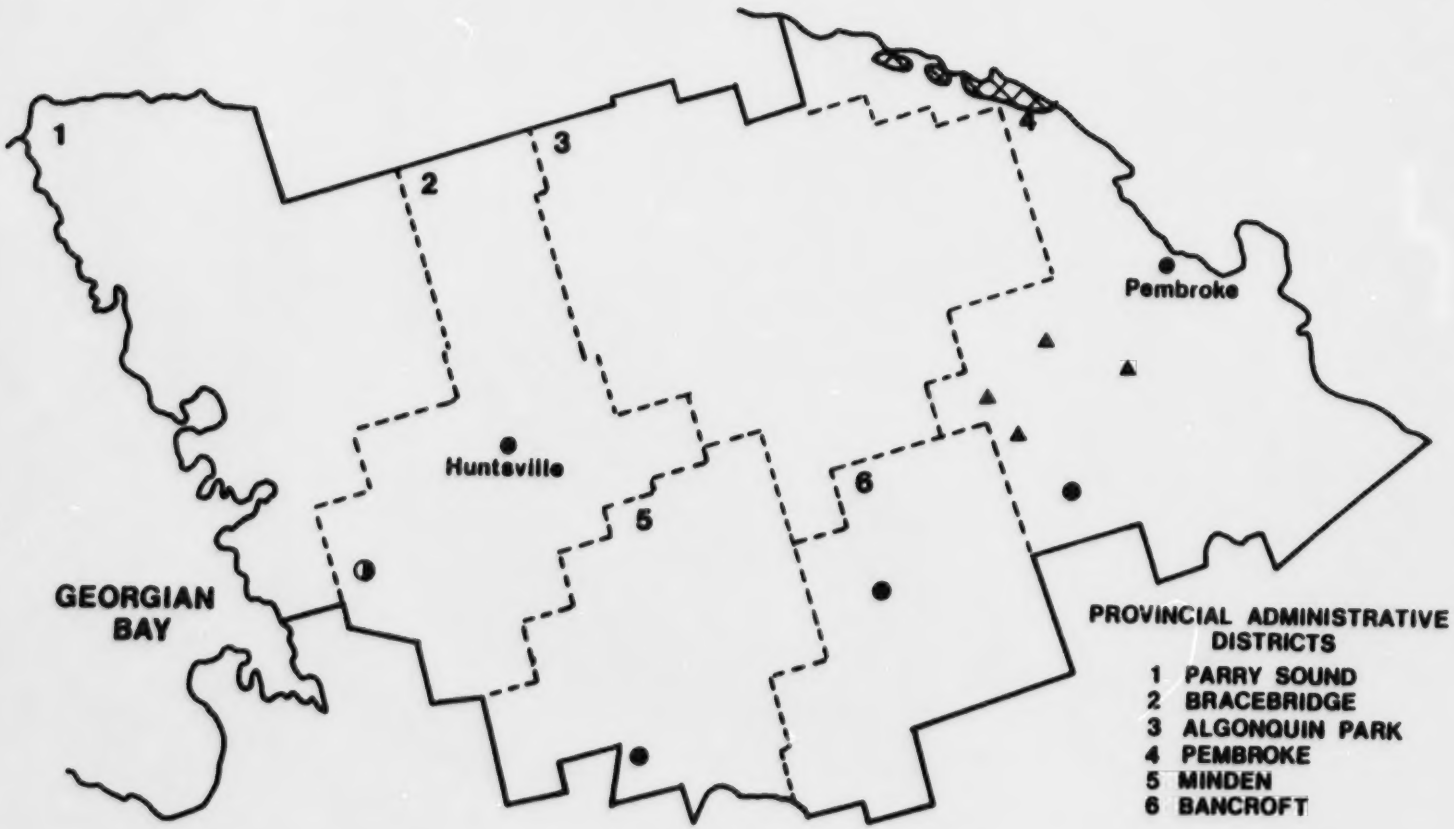


Figure 9. Jack Pine Sawfly (*Neodiprion pratti paradoxicus* Ross)

Areas within which defoliation occurred in 1987

Trace .....◑

Light .....▲

Moderate-to-severe ..... ⊠ or ●

Bruce Spanworm, *Operophtera bruceata* (Hlst.)

There was a marked increase in the total area of moderate-to-severe defoliation of sugar maple (*Acer saccharum* Marsh.) caused by this spanworm. The total area was estimated at 233,911 ha, almost a 50% increase over that reported in 1986 (Fig. 10). The largest increases occurred in the Minden and Bracebridge districts, whereas a decrease of approximately 30% occurred in Bancroft District. The total areas defoliated, by district, were: Algonquin Park - 4,755 ha; Bancroft - 76,380 ha; Bracebridge - 18,645 ha; Minden - 133,816 ha; and Pembroke - 315 ha.

The main body of continuously defoliated sugar maple stands extends from the northeastern corner of Wollaston Township, Bancroft District, and northwestward across the central portion of Minden District into Franklin Township, Bracebridge District. Pockets of defoliation, ranging in size from 130 to 550 ha, were detected at several locations outside the main area of defoliation. These were found in Brunel and Franklin townships in Bracebridge District, in Bruton and Lyell townships in Algonquin Park District and in Raglan and Sebastopol townships in Pembroke District. In Minden District the western edge of the infestation merged with the leading edge of the forest tent caterpillar infestation in Hindon, Anson and Minden townships. Therefore, any scattered pockets in this area were lost as a result of the feeding activity of the forest tent caterpillar.

Light defoliation, which was confined to regeneration or understory trees, was detected in numerous sugar maple stands in the southern half of Pembroke District and in most of Bancroft and Minden districts. Similar damage was found throughout the southern half of Bracebridge and Parry Sound districts.

Minor Insects

White Pine Cone Beetle, *Conophthorus coniperda* (Sz.)

This destructive white pine cone beetle was found causing damage to both cones and new shoots of eastern white pine on islands near Sans Souci in Georgian Bay, Parry Sound District. In all, 19 islands were found to be infested, from Bernice Island southward across Ajax and Fryingpan islands, to several of the islands in the Copperhead Harbour area, a distance of approximately 7.5 km.

Ground checks were made on Primrose and Isaac islands towards the south end of the infested area and on Island B360 at the northern end. Numerous one- and two-year-old aborted cones were found on the ground at the bases of white pine trees. The cones were aborted as a result of tunneling and feeding by larvae of this pest. At each location new shoots of white pine were also affected. When population levels become significantly high, the adults will attack the new shoots, tunneling into the twigs and causing the shoots to wither and die.

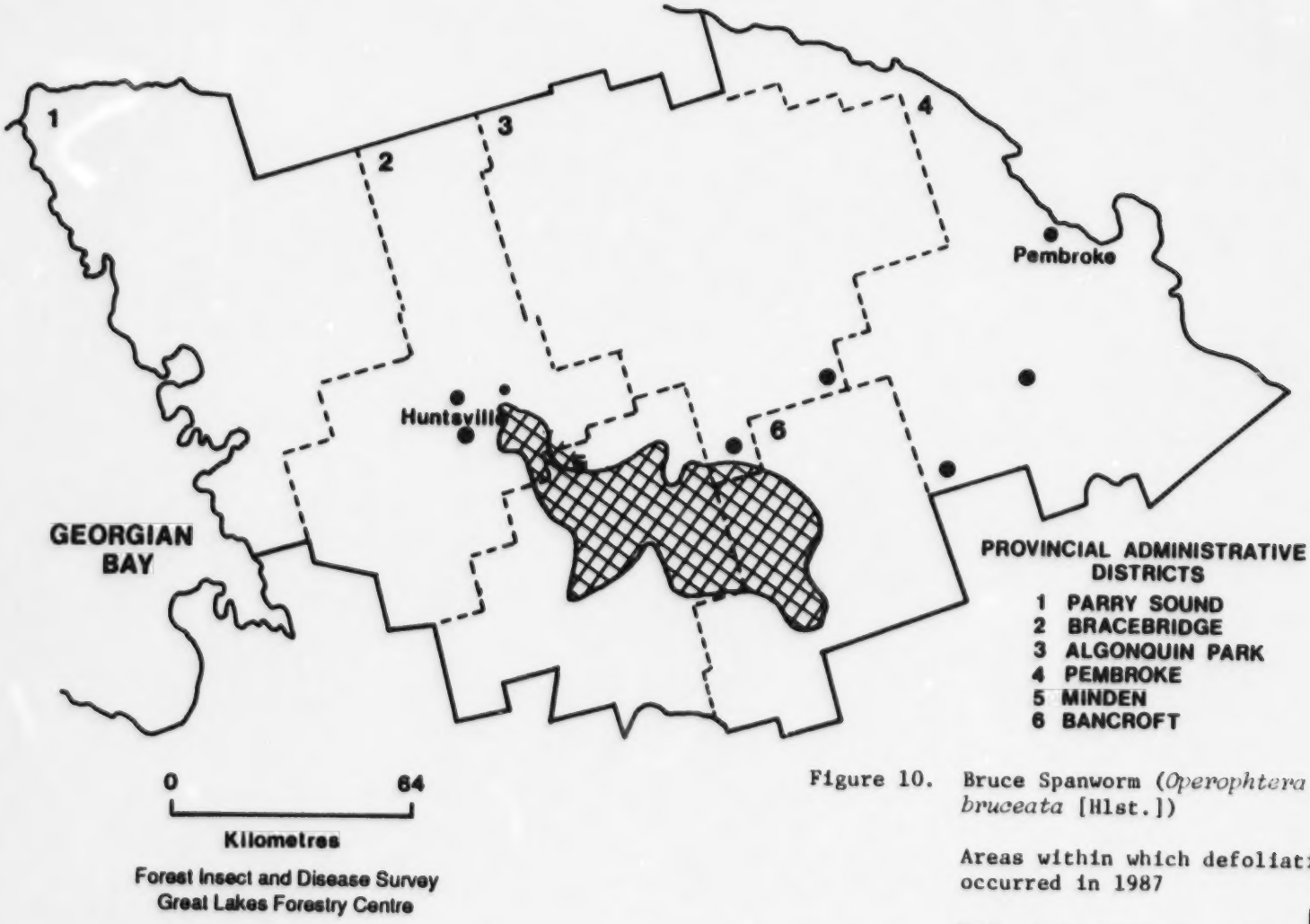


Figure 10. Bruce Spanworm (*Operophtera bruceata* [Hlst.])

Areas within which defoliation occurred in 1987

Moderate-to-severe ..... ⊠ or ●

Shoot damage as high as 80% was recorded on several branches of trees 10-15 m high. On Primrose Island and Island B360 this damage has occurred for at least three years and has resulted in whole-branch mortality on several trees. Two 12-m trees were found dead; it is believed that they had been weakened to such an extent by the repeated attack of the adult cone beetle that secondary pests, both insects and diseases, finally caused their death.

Poplar Flea Beetle, *Macrohaltica populi* Brown

An increase was observed in both the population levels and the severity of foliar damage caused by this flea beetle across the southern half of Bancroft and Pembroke districts. In Pembroke District high populations caused 95% defoliation of roadside balsam poplar (*Populus balsamifera* L.) along Hwy 41 from the town of Eganville to the village of Dacre. Moderate populations caused 50% defoliation in scattered pockets of roadside trees along Hwy 62 south of the town of Barry's Bay to the village of Combermere.

In Bancroft District, 50% defoliation was recorded in scattered pockets along Hwy 28 from south of the town of Bancroft to the village of Burleigh Falls.

Eastern Tent Caterpillar, *Malacosoma americanum* (F.)

Extremely high population levels of this tent caterpillar occurred across the entire region. In many areas, small roadside pin cherry (*Prunus pensylvanica* L.f.) and choke cherry (*Prunus virginiana* L.) trees were completely covered with webbing and devoid of foliage. Along Muskoka County Road 13 in Wood Township, Bracebridge District, caterpillars stripped scattered clumps of cherry and then migrated to scrub red oak and bur oak, 6-8 m high, that were growing on bare rock. Defoliation often exceeded 75% on several of these trees at numerous locations along the road. This type of damage to scrub oak also occurred along Hwy 36 in Harvey Township, Minden District and along Hwy 28 in Burleigh Township, Bancroft District.

Flat Leaftier, *Psilocorsis reflexella* Clem.

This leaftier was very commonly encountered in numerous areas across the western half of the region. Trembling aspen (*Populus tremuloides* Michx.) and red oak were the tree species most often affected. Small scattered pockets, about 0.5 ha in size, were often completely brown by mid- to late August as a result of the work of this leaftier.

The heaviest damage was detected on red oak and bur oak on the west side of Gull Lake in Lutterworth Township, and south of Four Mile Lake in Somerville Township, both in Minden District. Leaf damage in these two areas ranged from 10 to 100%. Similar levels of damage were found on trembling aspen, red oak and bur oak along Muskoka County Road 13 in Wood Township, Bracebridge District, and on trembling aspen along Hwy 124 through Hagerman and Craft townships, Parry Sound District (Fig. 11).

Moderate levels of damage (20-60%) were detected in mixed hardwood stands that ranged from 10 to 20 ha in size in Harrison, Carling and Gibson townships, Parry Sound District and in Cardwell and Franklin townships, Bracebridge District. This level of damage was also noted in a 50-ha mixed hardwood area along Hwy 507 in Cavendish Township and on roadside trembling aspen at Maple Lake in Stanhope Township, both in Minden District.

At numerous locations elsewhere in the region, this leaftier was commonly seen causing browning of 5-10% of the oak and aspen leaves.

Maple Webworm, *Tetralopha asperatella* (Clem.)

For the second consecutive year this webworm was commonly found affecting sugar maple at numerous locations across the region. Damage levels of 30-40% were detected in a 50-ha stand south of Ardbeg in East Burpee Township and in a 20-ha mixed hardwood stand at the junction of Hwy 69 and Muskoka County Road 33 in Gibson Township, both in Parry Sound District. The same level of damage was found in a 10-ha sugar maple stand east of the town of Minden, in Minden Township, Minden District.

A defoliation level of 20% was recorded in a 25-ha mixed hardwood stand along Muskoka County Road 12 in Freeman Township, Parry Sound District, and in a 20-ha stand on the west side of Kushog Lake in Stanhope Township, Minden District. Defoliation levels in the 5-10% range were noted along Hwy 503 in Laxton Township, Minden District, and in a 50-ha stand, predominantly of sugar maple, east of Baysville in Ridout Township, Bracebridge District.

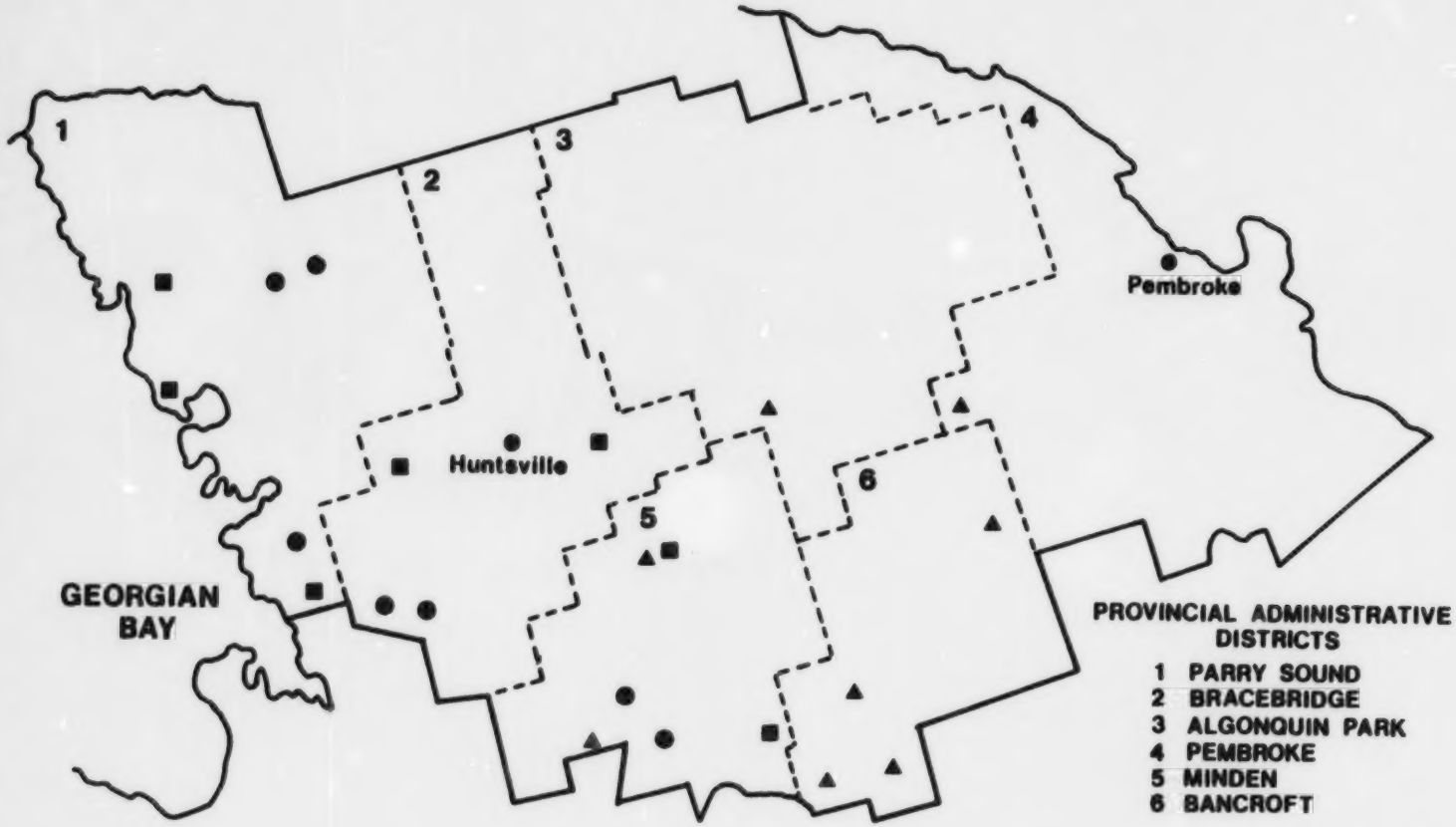


Figure 11. Flat Leaftier (*Psilocorsis reflexella* Clem.)

Areas within which various population levels were recorded in 1987

Light ..... ▲

Moderate ..... ■

Heavy ..... ●

Table 6. Other forest insects

Insect	Host(s)	Remarks
Aphrophora saratogensis (Fitch) Saratoga spittlebug	rP	10% branch and 2% total tree mortality in a 0.5-ha pocket of a 10-ha young plantation in Raglan Twp; low numbers recorded in Hagarty and Fraser twps, Pembroke District
Cameraria hamadryadella (Clem.) Solitary oak leafminer	wO, bO	30-40% of the leaves mined on red oak and bur oak along Hwy 169 in the Bala area of Wood Twp, Bracebridge District; 10% defoliation on several roadside bur oak at Beech Lake in Stanhope Twp, Minden District
Coleophora laricella (Hbn.) Larch casebearer	tL	3% defoliation recorded in small, scattered pockets on roadside trees in Westmeath and Admaston twps, Pembroke District
Contarinia baeri (Prell) European pine needle midge	rP	3-5% defoliation reported on 40% of the 1-m-tall trees in a 1-ha plantation in Monteagle Twp; a similar plantation 15% infested in Burleigh Twp, Bancroft District; 1% defoliation common across the entire work area
Corythucha sp. Lace bug	wE, W, Ba	100% affected foliage common on white elm, willow (*Salix* spp.) and, to a lesser extent, basswood (*Tilia americana* L.) from Deep River to Arnprior, Pembroke District
Diprion similis (Htg.) Introduced pine sawfly	scP	Two small colonies were collected from a 4-ha plantation in McMurrich Twp, Parry Sound District.

(cont'd)

Table 6. Other forest insects (cont'd)

Insect	Host(s)	Remarks
Erannis tiliaria (Harr.) Linden looper	Be	75% defoliation in a 0.25-ha hardwood stand along Hwy 518 east of Orrville in Christie Twp, Parry Sound District; low numbers present along Hwy 507 near Gooderham in Glamorgan Twp, and along Hwy 121 from Minden to Haliburton in Minden District
Eucosma gloriola Heinr. Eastern pine shoot borer	rP	Trace populations with less than 1% of the young trees infested were observed in two plantations in Monteagle Twp, Bancroft District. Similar damage was observed in Westmeath Twp, Pembroke District.
Fenusa pusilla (Lep.) Birch leafminer	wB	100% infected foliage observed on roadside trees across the Bancroft District and in Pentland Twp, Algonquin Park District, 50 to 75% infected foliage common in natural stands near the town of Huntsville, Bracebridge District and around McKellar, Dunchurch and Magnetawan, Parry Sound District; 30% damage levels widely spread across Pembroke District; common on ornamental trees across the remainder of the region
Gonioctena americana (Schaef.) American aspen beetle	bPo, tA	95% damage levels on balsam poplar along Hwy 41 from Eganville to Griffith; 50% damage observed along Hwys 62, 515, and 514 from Barry's Bay to Hardwood Lake, Pembroke District; trembling aspen foliage 40% affected in McClure Twp, Bancroft District; 5% damage levels observed in balsam poplar across the eastern portion of Minden District

(cont'd)

Table 6. Other forest insects (cont'd)

Insect	Host(s)	Remarks
Messa nana (Klug) Early birch leaf edgeminer	wB	75% infested foliage on scattered individual trees along Hwy 127 in Cardiff Twp and from the town of Bancroft to the town of Apsley, Bancroft District
Neodiprion nanulus nanulus Schedl. Red pine sawfly	rP	25% defoliation recorded in a 5-ha mature, natural stand in Bromley Twp; 20% defoliation in a young plantation 0.5-ha in size in Westmeath Twp, Pembroke District; trace population levels observed in many other locations in the southern half of Pembroke District
Neodiprion sertifer (Geoff.) European pine sawfly	mP, rP	Nine percent of the Mugho pines (*Pinus mugo* Turra var. *mughus* Zenari) had an average of one colony per tree, which caused approximately 5% defoliation along Hwy 11 in Macaulay Twp, Bracebridge District.
Paraclemensia acerifoliella (Fitch) Maple leafcutter	sM	20% defoliation in a 10-ha sugar bush near the town of Eganville in Wilberforce Twp, Pembroke District; trace levels observed in Faraday Twp, Bancroft District, and in Blithfield Twp, Pembroke District
Pikonema alaskensis (Roh.) Yellowheaded spruce sawfly	wS	an average of 28% defoliation of 55% of the 1-m trees in a 5-ha plantation in Digby Twp, Minden District; 50% defoliation on approximately half the young trees in a 0.5-ha roadside plantation in Sproule Twp, Algonquin Park District; 70% defoliation observed on 10 trees in a small pocket of a young plantation, 0.25 ha in size, in Cardiff Twp, Bancroft District; trace levels recorded along Con. Road 5 in Proudfoot Twp, Bracebridge District

(cont'd)

Table 6. Other forest insects (cont'd)

Insect	Host(s)	Remarks
Pissodes approximatus Hopk. Northern pine weevil	rP, wP	80% mortality recorded in an ornamental planting of red pine in a campground in Canisbay Twp, Algonquin Park District; 1% mortality found in 1.5-m-high white pine in a 2-ha plantation in Horton Twp, Pembroke District
Pissodes strobi (Peck) White pine weevil	wP, nS	Sixty percent of the leaders were attacked in 3.8-m-high Norway spruce (*Picea abies* [L.] Karst.) in a 2-ha plantation in Buchanan Twp; 36% of the 3-m-high white pine in a 4-ha plantation and 31% of the 4-m-high trees in a 1.5-ha plantation had infested leaders in Ross Twp; 3.4-m-high trees in a 6-ha plantation had 18.7% of these leaders attacked in Wilberforce Twp, Pembroke District; 5-10% leader attack was common across the region.
Podapion gallicola Riley Pine gall weevil	rP	10% of the branches infested on mature trees at campsites on Opeongo Lake in Dickson Twp, Algonquin Park District; trace levels observed along Hwy 17 in Maria Twp and in Sherwood Twp, Pembroke District
Pristiphora erichsonii (Htg.) Larch sawfly	larch	Trace numbers (one to two colonies per tree) could be found on ornamentals at Mew Lake campground in Canisbay Twp, Algonquin Park District.
Pristiphora geniculata (Htg.) Mountain-ash sawfly	As	90% defoliation of ornamental trees observed in Grundy Lake Provincial Park, Parry Sound District; trace levels found widely scattered across the work area

(cont'd)

Table 6. Other forest insects (concl.)

Insect	Host(s)	Remarks
Toumeyella parvicornis (Ckll.)	jP	100% of 3-m-high trees infested in a small portion of a natural stand in Maria Twp, Pembroke District; single 1.5-m-high trees heavily attacked in White Twp, Algonquin Park District

TREE DISEASES

Major Diseases

Anthracnose, *Apiognomonia errabunda* (Roberge) Höhnel,
Discula betulina (Westend.) v. Arx,
Discula campestris (Pass.) v. Arx

This group of pathogens was very active again in 1987, and caused a wide range of foliar damage to many hardwood species across the entire southern half of the region.

The heaviest damage (90% defoliation) was caused by *Discula betulina* in scattered pockets of white birch across hwys 60 and 62 from the town of Pembroke to the west side of Algonquin Park. Damage in the 80% range occurred south from the town of Barry's Bay along Hwy 62 to the town of Bancroft in the Pembroke and Bancroft districts. Foliar damage of 25 to 75% occurred along Hwy 28 from the town of Bancroft to the village of Burleigh Falls in Bancroft District. This pathogen caused 30% defoliation across the northern end of Parry Sound District.

The second most widely recorded disease was *Apiognomonia errabunda*, which caused 70% defoliation of scattered roadside beech (*Fagus grandifolia* Ehrh.) in Faraday Township, Bancroft District. In Pembroke District there was 20% defoliation in pockets of sugar maple in Radcliffe Township and 5% defoliation of scattered red maple in Richards Township. Red oak and bur oak sustained as much as 30% defoliation of scattered individuals around Maple Lake in Stanhope Township and Gull Lake in Lutterworth Township, both in Minden District. Similar damage levels were detected along the Muskoka lakes in Wood Township, Bracebridge District.

Sugar maples sustained up to 30% defoliation by *Discula campestris* in pockets <1 ha in size along Hwy 118 in Hindon Township, Minden District and Oakley Township, Bracebridge District. Up to 20% defoliation of widely scattered roadside sugar maples was recorded in Horton Township, Pembroke District.

Armillaria Root Rot, *Armillaria mellea* (Vahl:Fr.) Kummer

This root rot was commonly detected in numerous softwood and hardwood stands throughout the region. In softwood plantations damage is usually detected in 5- to 10-year-old plantings, causing 1-3% mortality. In hardwood stands trees that are placed under stress by other biotic and abiotic agents are often attacked by this disease. Mortality can range from 2 to 40% in heavily stressed stands, as seen in the Ganaraska County Forest, Lindsay District (Central Region) in 1976, after an outbreak of the oak leaf shredder (*Croesia semipurpurana* Kft.).

Damage was detected in 1987 in five red pine plantations. Standard 150-tree evaluations revealed an average of 1% current mortality caused by this disease at each site. The complete results are summarized in Table 7.

Additional information about this disease can be found in the section of this report entitled White Spruce Plantation Survey.

Table 7. Summary of damage caused by Armillaria root rot at locations in the Algonquin Region in 1986 (counts based on the examination of a minimum of 150 trees at each location).

Location (Twp)	Tree species	Avg ht of trees (m)	Total area affected (ha)	Trees affected (%)	Current mortality (%)
Algonquin Park District					
Sproule	rP	15.0	1.5	2	1
Minden District					
Somerville	rP	15.0	16.0	1	1
Parry Sound District					
McMurrich	rP	0.8	1.0	1	1
Ryerson	rP	2.2	10.0	1	1
	rP	2.3	3.0	1	1

Scleroderris Canker, *Ascocalyx abietina* (Lagerb.) Schläpfer-Bernhard

Extensive aerial and ground surveys were conducted across the region for evidence of either the native or the more virulent European race of this disease. In all, 88 pine (*Pinus* spp.) plantations were evaluated, and a minimum of 500 trees were examined at each site (Fig. 12). Serological testing confirmed eight new infection centers of the European race in 1987, all but one of them close to previously confirmed sites. The data recorded during the evaluation of these 88 plantations are summarized in Table 8.

In Mayo Township, Bancroft District, four red pine plantations were affected in 1987; there are now seven confirmed sites of the European race in this township. The disease affected 2% of the trees in a five-year-old 2-ha plantation and a 16-year-old 40-ha plantation. Two 18-year-old 1-ha plantations had 1% and 6% of their trees affected, and the current mortality rate was 1% in the second, more heavily infected,

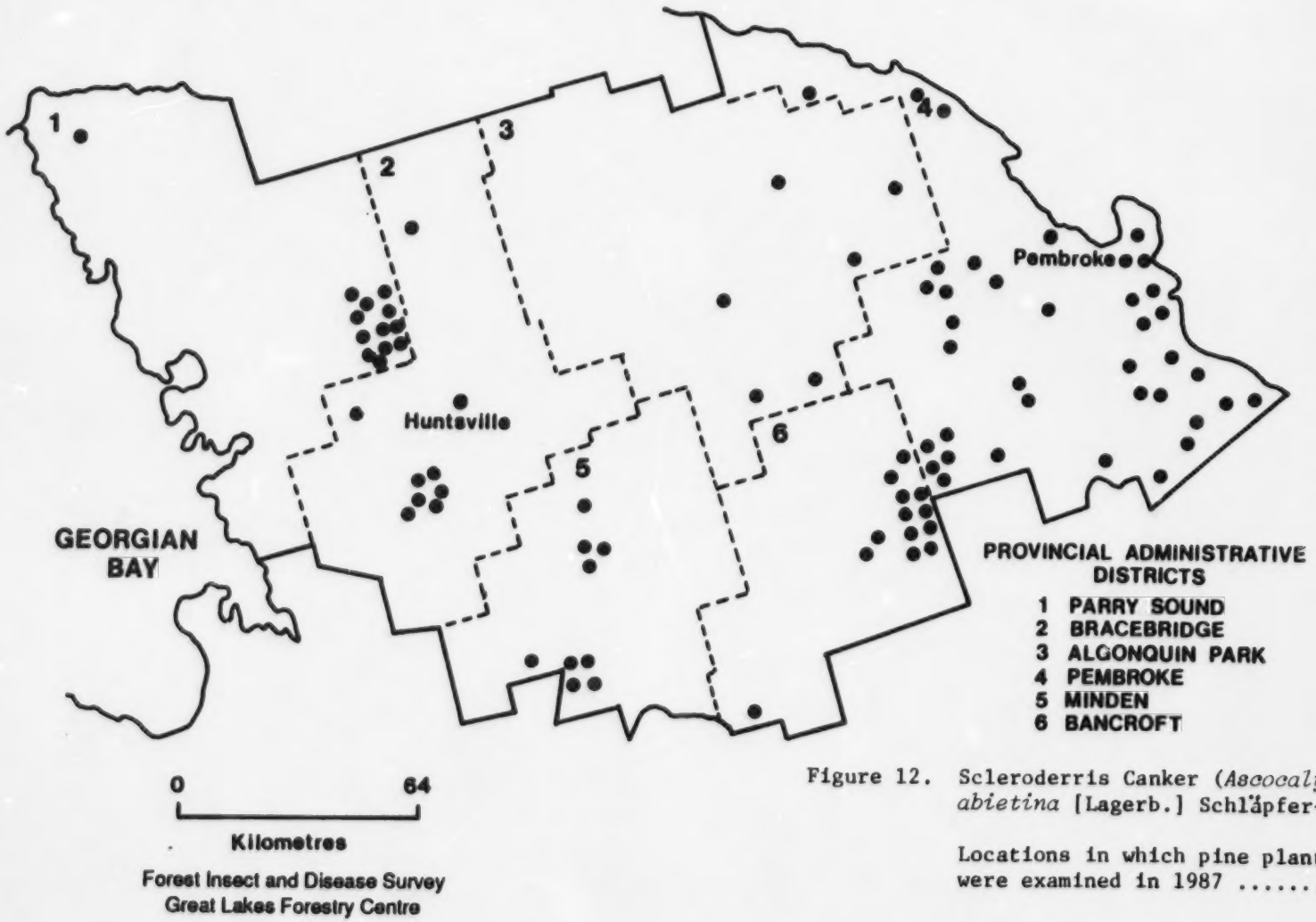


Figure 12. Scleroderris Canker (*Ascocalyx abietina* [Lagerb.] Schläpfer-Bernhard)

Locations in which pine plantations were examined in 1987 .....●

plantation. In Macaulay Township in Bracebridge District, 2% of a five-year-old 1-ha red pine plantation and 4% of a 12-year-old 3-ha red pine plantation were affected. These two findings bring the total number of confirmed sites to four in this township. In McMurrich Township in Parry Sound District, 6% of a 14-year-old 5-ha red pine plantation was affected and an estimated 2% current, whole-tree mortality occurred as a direct result of the disease. Two Scots pine (*Pinus sylvestris* L.) plantations, both approximately 20 years old, were estimated to have 10% of their trees affected. The infection occurred mainly along the open edges of the stands. Both plantations border a red pine plantation that was serologically tested and confirmed to be infected with the European race of the fungus in 1986. These three sites bring the total number of infected areas to six in McMurrich Township (Fig. 13). An additional new infection center has been confirmed in Ryerson Township, Parry Sound District. In a 1-ha red pine plantation, 30% of the 2.3-m-tall trees were found to be affected. A second red pine plantation on the same property was found to have 3% of its 4.0-m-high trees infected, also with the European race.

Control operations were conducted by OMNR staff at all confirmed sites except the one in Ryerson Township. This site was not confirmed until midwinter of 1988, whereas the other seven sites were confirmed during the summer of 1987 and the control operations were conducted in September and October of that year. Dead, cankered trees or those that had more than 50% of their branches infected were cut and burned. Trees with only two or three branches infected at ground level were pruned to two thirds of their total height and the branches were burned. The lower (uninfected) branches of the remaining trees in the plantations were pruned and left on the ground; the majority of infections occur initially in these branches.

Minor Diseases

Tar Spot Needle Cast, *Davisomycella ampla* (J. Davis) Darker

There was a decrease in the incidence of this needle cast on jack pine in the region. The heaviest damage, with 30% of the foliage affected, was recorded on scattered individual trees in a 15-ha stand north of the town of Deep River in Rolph Township, Pembroke District. Moderate damage levels (20 to 25%) were recorded in the Round Lake area of Richards Township, Pembroke District and south of Lake Traverse in Edgar Township, Algonquin Park District.

Small, scattered pockets of jack pine, with 10 to 15% of the foliage affected, were observed throughout the area. The host species was found north of a line running along Hwy 41 from the town of Pembroke south to the town of Eganville, then west to the village of Combermere in Pembroke District.

Table 8. Results of a special survey for Scleroderris canker at 88 locations in Algonquin Region in 1987 (counts based on the examination of 500+ red pine trees at each location).

Location (Twp)	Tree ht (m)	Total trees per ha	Total area examined (ha)	Trees affected (%)	Trees dead (%)
Algonquin Park District					
Sproule	21.0	1,600	1	0	0
Sabine	7.0	2,500	1	0	0
Guthrie	8.8	1,200	10	0	0
White	4.5	2,500	4	0	0
Stratton	4.5	2,400	1	0	0
Maria	5.0	2,500	4	0	0
Lyell	6.5	2,200	8	0	0
Bancroft District					
Dungannon	7.0	2,500	3	0	0
	1.0	2,500	6	0	0
Mayo	7.0	1,600	6	0	0
	17.0	1,800	8	0	0
	0.5	2,500	2	2[a]	0
	0.5	2,000	5	0	0
	6.0	2,300	40	2[a]	0
	8.0	2,500	12	0	0
	3.8	2,400	15	0	0
	2.9	2,000	3	0	0
	6.0	2,300	1	1[a]	0
	6.0	2,100	1	6[a]	1
Burleigh	7.5	1,300	2	0	0
Carlow	2.1	2,500	3	0	0
Bracebridge District					
Macaulay	2.5	2,100	3	4[a]	0
	0.4	1,000	1	2[a]	0
	4.5	2,100	3	0	0
	0.5	1,200	1	0	0
	4.0	1,900	2	0	0
	5.0	2,100	2	0	0
Strong	20.0	1,000	3	0	0
Cardwell	4.0	2,000	2	0	0

(cont'd)

Table 8. Results of a special survey for Scleroderris canker at 88 locations in Algonquin Region in 1987 (counts based on the examination of 500+ red pine trees at each location) (cont'd).

Location (Twp)	Tree ht (m)	Total trees per ha	Total area examined (ha)	Trees affected (%)	Trees dead (%)
Minden District					
Somerville	15.0	900	16	0	0
	14.0	1,500	10	0	0
	12.0	1,100	6	0	0
Minden	15.0	1,800	3	0	0
	9.0	2,300	2	0	0
	9.0	2,300	8	0	0
Stanhope	12.0	1,800	5	0	0
Laxton	1.0	2,200	4	0	0
	1.7	1,800	7	0	0
Parry Sound District					
McMurrich	12.0	1,700	3	0	0
	12.0	2,200	2	0	0
	15.0	1,900	2	0	0
	0.8	2,200	1	0	0
	2.0	1,900	5	6[a]	2
	1.5	2,000	10	0	0
Mowat	10.0	1,700	2	0	0
	9.0	2,100	4	0	0
Ryerson	2.2	1,900	3	1[a]	0
	2.5[b]	1,000	5	0	0
	4.0	2,000	4	3[a]	0
	2.3	2,000	1	30[a]	1
	12.0	1,700	1	0	0
Pembroke District					
Sebastopol	2.2	2,500	3	0	0
Raglan	5.7	2,500	10	0	0
	6.2	2,200	4	0	0
	5.5	2,400	3	0	0
	6.5	2,400	3	0	0
	10.0	2,500	10	0	0
Hagarty	2.0	2,400	12	0	0
	4.5	1,700	8	0	0
	1.0	2,500	12	0	0

(cont'd)

Table 8. Results of a special survey for Scleroderris canker at 88 locations in Algonquin Region in 1987 (counts based on the examination of 500+ red pine trees at each location) (concl.)

Location (Twp)	Tree ht (m)	Total trees per ha	Total area examined (ha)	Trees affected (%)	Trees dead (%)
Pembroke District (cont'd)					
Richards	5.3	2,000	8	0	0
	5.5	2,000	1	0	0
	5.0	1,400	2	0	0
Horton	14.6	1,600	2	0	0
	3.5	2,000	3	0	0
Fraser	7.0	2,200	3	0	0
	1.5	2,400	1	0	0
Westmeath	5.0	1,800	1	0	0
	4.7	2,500	2	0	0
	14.4	1,500	4	0	0
Ross	4.7	2,500	2	0	0
	4.7	2,500	8	0	0
	3.5	2,400	10	0	0
	2.0	2,500	4	0	0
Rolph	10.1	2,500	2	0	0
	1.5	1,200	15	0	0
McNab	6.5	2,500	2	0	0
	11.5	2,000	6	0	0
Bagot	8.1	2,200	5	0	0
	12.2	1,500	2	0	0
Admaston	6.2	2,200	2	0	0
	6.5	2,200	5	0	0
	8.0	2,400	12	0	0
Blithfield	9.0	2,500	6	0	0
Wilberforce	5.0	2,500	5	0	0
Brougham	9.6	2,400	24	0	0
Lyndoch	4.1	1,800	4	0	0

[a] positive identification of the European race of Scleroderris canker

[b] Scots pine examined at this location

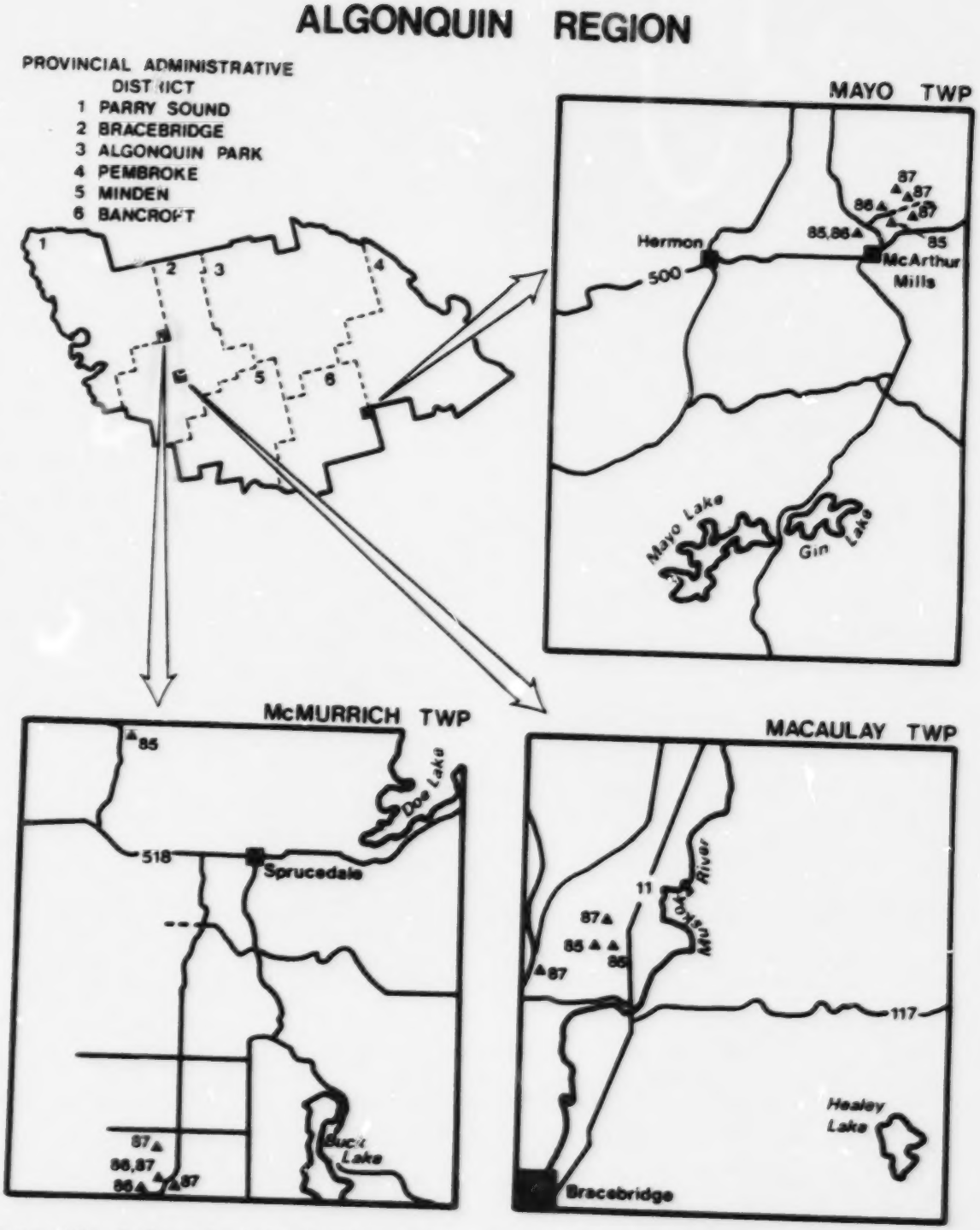


Figure 13. Scleroderris Canker (*Ascocalyx abietina* [Lagerb.] Schläpfer-Bernhard)

Locations of confirmed sites of the European race of Scleroderris canker in the Algonquin Region since it was first reported in 1985

Poplar Leaf Disease, *Linospora tetraspora* G.E. Thompson, *Marssonina castagnei* (Desm. & Mont.) Magnus, *Melampsora medusae* Thüm., *Mycosphaerella populicola* G.E. Thompson

There was a marked decrease in defoliation caused by various leaf spots and blights in the western half of the region, whereas the eastern half sustained heavy defoliation similar to that recorded in 1986.

The heaviest damage was caused by *Mycosphaerella populicola*, and affected 100% of the foliage on balsam poplar in scattered pockets that ranged in size from 0.5 to 2 ha along Hwy 62 south of the town of Bancroft in Bancroft District. Foliar damage levels of up to 30% were common across the lower portion of Minden District. Elsewhere across the work area, virtually every pocket of balsam poplar had some level of infection.

Along the Madawaska River Valley, from the village of Combermere to the village of Calabogie in Pembroke District, *Linospora tetraspora* caused up to 90% defoliation in scattered pockets of balsam poplar.

Silver poplar (*Populus alba* L.), planted as an overstory in an eastern white pine plantation, was found heavily infected with the leaf spot *Marssonina castagnei*. Defoliation levels ranged from 20 to 100%, and resulted in 10% whole-tree mortality in Wilberforce Township, Pembroke District.

Hybrid poplar planted over a 4-ha eastern white pine plantation in Ross Township, Pembroke District was affected by the larch-poplar rust (*Melampsora medusae* Thüm.) and sustained 25% defoliation.

Leaf Blight, *Septoria betulae* Pass.

For the second consecutive year this leaf blight caused heavy discoloration of white birch (*Betula papyrifera* Marsh.) across much of the northern portion of the region. At numerous locations white birch were severely yellowed by mid-August and devoid of foliage by early September.

Trees with 75% or more of their leaves affected were observed across the northern half of Parry Sound, Bracebridge and Algonquin Park districts. Similar levels of damage were noted throughout much of Minden District and the north central portion of Pembroke District.

Damage levels ranging from 10 to 20% were encountered in the southern portions of Parry Sound and Bracebridge districts. Occasionally, single trees or clumps <0.5 ha in size were observed to be affected to the same extent at several locations in Bancroft District.

Table 9. Other forest diseases

Disease	Host(s)	Remarks
Ceratocystis ulmi (Buism.) C. Moreau Dutch elm disease	wE	25% of individual young roadside trees affected in Wilberforce Twp, Pembroke District; common in most areas wherever the host is found across the region
Ciborinia whetzelii (Seaver) Seaver Ink spot of aspen	tA	5% affected foliage in 0.5-ha roadside pockets of natural stands in Fitzgerald Twp, Algonquin Park District
Coleosporium asterum (Dietel) Sydow Pine needle rust	rP	2-3% defoliation of single 5-m-tall trees in a 2-ha plantation in Ross Twp and of 3.6-m-tall trees growing in a shelter belt in Alice Twp, Pembroke District; 1% defoliation of 11% of the 4.4-m-tall trees in a 3-ha plantation in Minden Twp, Minden District
Cronartium ribicola J.C. Fischer White pine blister rust	wP	trace levels causing up to 1% mortality common across the eastern half of the region; 2% infection rate on branches only in a 0.5-ha area of 2.5-m-tall natural regeneration trees along Hwy 121 west of the town of Kinmount in Lutterworth Twp, Minden District
Endocronartium harknessii (J.P. Moore) Y. Hirats. Western gall rust	jP	1% of 5-m-tall trees affected in a 12-ha plantation in Rolph Twp, Pembroke District
Eutypella parasitica Davidson & Lorenz Eutypella canker	sM	An infection rate of 4% was recorded in stands examined at Hardy Lake in Wood Twp, Bracebridge District and at Killbear Provincial Park in Carling Twp, Parry Sound District.

(cont'd)

Table 9. Other forest diseases (concl.)

Disease	Host(s)	Remarks
Hypoxylon mammatum (Wahlenb.) J. Miller Hypoxylon canker	tA	5% of young, scattered trees affected in small pockets in Sebastopol Twp, Pembroke District, and a mortality rate of 2%
Kabatina thujae A. Schneider & v. Arx var. *thujae* Needle blight	eC	75% of the foliage affected on scattered ornamental trees in the town of Minden, Minden District
Lophodermella concolor (Dearn.) Darker Needle cast	jP	80% defoliation in isolated small, scattered pockets along the Achray Rd in White Twp, Algonquin Park District
Phellinus everhartii (Ell. & Gall.) A. Ames White spongy rot	rO	Fruiting bodies of this disease were found during evaluations of oak decline near the Bracebridge Resource Centre, Bracebridge District.
Phellinus tremulae (Bondartsev) Bondartsev & Borisov White trunk rot	tA	Special collections were made across the region for fruiting bodies of this disease. This very common conk was easily found in all areas of the region.
Phyllosticta minima (Berk. & Curt.) Underw. & Earle Leaf spot	rM	75% of the leaves affected on roadside regeneration in the Halls Lake area of Stanhope Twp, Minden District
Tubakia dryina (Sacc.) B. Sutton Leaf spot	rO	60% of foliage affected on scattered, individual roadside trees from the town of Apsley to the village of Burleigh Falls, Bancroft District
Venturia macularis (Fr.) E. Müller & v. Arx Shoot blight	tA	very common on roadside regeneration throughout the central portion of Minden District and southern portion of Bracebridge District

DIEBACKS AND DECLINES

Maple Decline

In an attempt to determine if there is a maple decline problem in Ontario maple bushes, a series of impact plots was established to rate and monitor crown conditions in sugar maple stands. In all, 40 plots are to be located randomly in the Algonquin Region. Twenty were established in 1987, and the remainder will be established in the summer of 1988 (Fig. 14).

At each plot location, 25 dominant or codominant host trees were selected randomly and marked to ensure that the same trees are evaluated annually. Height, diameter, stem defects and pest problems were also recorded for each tree. By means of a standard crown dieback classification system, the individual crowns were evaluated and the percentage of current and total dieback was recorded. In all, 352 trees (70.4%) were considered very healthy as they had little or no current dieback (<5%); only 18 trees (3.6%) were considered to have a high level of current dieback (>25%). In the total dieback categories only 122 trees (24.4%) were considered healthy, whereas 201 trees (40.2%) were considered to have >25% of their crown dead. However, only 26 of these trees, scattered across nine plots, were considered to have >40% of their crown affected and only one tree on one plot was determined to have >60% of its crown dead (Table 10).

Defoliation caused by the forest tent caterpillar, ranging from 30% in Gibson Township, Parry Sound District to 100% in Minden Township, Minden District, was detected in five of the stands, and defoliation caused by the Bruce spanworm, ranging from 2% in Carling Township, Parry Sound District to 100% in Minden Township, Minden District was found in seven of the stands. Gypsy moth caused 5% defoliation in the stand in Limerick Township, Bancroft District. Frost cracks on the main stems were very common on all plots, and a total of 129 trees were affected. Eutypella canker (*Eutypella parasitica* Davidson & Lorenz) was found to be affecting 13 of the trees, and the sugar maple borer (*Glycobius speciosus* [Say]) was found on 20 of the trees. The damage caused by frost cracks, Eutypella canker and the sugar maple borer has a serious impact on the individual tree's vigor, but all four factors cause open wounds that serve as entrance courts that permit numerous other insects and diseases to invade the trees. Each pest problem adds to the stress conditions of the tree and may contribute to future crown decline.

Red Oak Decline

The annual evaluation of the three red oak decline plots in the region revealed that significant crown deterioration had occurred in the plot in Macaulay Township, Bracebridge District. The proportion of trees on this plot with < 5% current dieback decreased from 79% in 1986 to a low of 22% in 1987. This dieback was attributed to two factors.

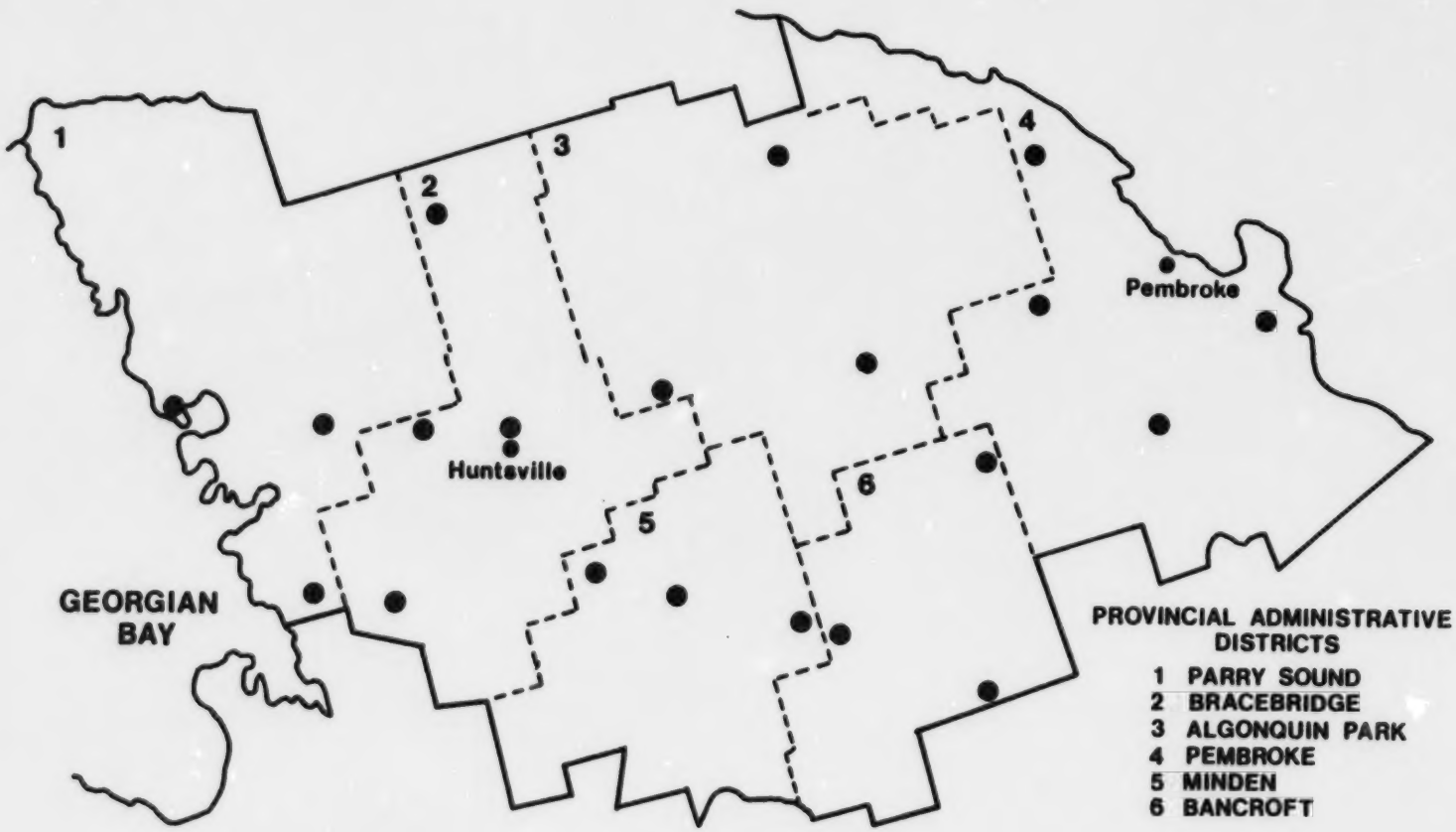


Figure 14. Maple Decline

Locations of the semipermanent maple decline plots established in 1987 .....●

Table 10. Summary of data collected from 20 semipermanent plots established in Algonquin Region in 1987 to monitor the condition of sugar maple stands (data based on the examination of 25 host trees at each location).

Location (Twp)	Avg DBH (cm)	Avg tree ht (m)	Dieback class[a]											
			Current						Total					
			0	1	2	3	4	5	0	1	2	3	4	5
Algonquin Park District														
Deacon	32.5	19.5	14	11	0	0	0	0	0	3	18	4	0	0
Murchison	41.0	22.2	17	8	0	0	0	0	0	9	16	0	0	0
Peck	36.3	20.7	15	10	0	0	0	0	0	4	17	4	0	0
Bancroft District														
Bangor	44.9	23.3	13	12	0	0	0	0	0	6	13	6	0	0
Cardiff	32.3	22.6	11	12	2	0	0	0	0	3	13	0	0	0
Limerick	31.8	23.2	21	4	0	0	0	0	0	6	16	3	0	0
Bracebridge District														
Chaffey	31.6	23.7	24	0	0	1	0	0	14	10	0	0	1	0
Machar	34.4	24.4	24	1	0	0	0	0	12	11	2	0	0	0
Sisted	29.9	23.9	16	9	0	0	0	0	10	15	0	0	0	0
Wood	31.3	22.3	24	1	0	0	0	0	17	7	1	0	0	0
Minden District														
Hindon	35.9	25.6	21	4	0	0	0	0	9	16	0	0	0	0
Minden	41.0	25.1	6	11	5	3	0	0	5	12	5	3	0	0
Monmouth	30.4	23.2	21	4	0	0	0	0	12	11	2	0	0	0
Pembroke District														
Richard	40.5	27.9	16	9	0	0	0	0	0	10	15	0	0	0
Ross	43.5	23.6	13	12	0	0	0	0	0	12	13	0	0	0
Sebastopol	40.2	22.1	18	7	0	0	0	0	0	15	9	1	0	0
Wylie	37.0	24.4	23	2	0	0	0	0	0	5	17	3	0	0
Parry Sound District														
Carling	30.6	22.8	25	0	0	0	0	0	25	0	0	0	0	0
Christie	31.7	20.1	8	10	7	0	0	0	3	14	7	1	0	0
Gibson	27.1	20.8	22	3	0	0	0	0	15	8	2	0	0	0

a Dieback classification: 0 = 0-5%, 1 = 6-20%, 2 = 21-40%, 3 = 41-60%, 4 = 61%+, 5 = dead tree

First, the newly flushed oak foliage was severely damaged or killed by heavy frosts in early May. Then, as the adventitious buds began to flush three to four weeks later, they were completely consumed by the forest tent caterpillar. This resulted in the death of many twigs and entire branches.

The remaining two plots, in Alice and Wylie townships, Pembroke District, were not affected by the two stress factors mentioned above. There was very little change in the overall vigor and condition of the crowns in the Alice and Wylie township plots. This can readily be seen in Table 11, which summarizes the data collected from the three plots for the past four years.

Table 11. Results of the evaluation of data collected from three semipermanent plots established in the Algonquin Region in 1977 to monitor red oak decline (data based on the examination of 100 host trees at each location).

Location (Twp)	Avg DBH of sample trees (m)	Stand size (ha)	Year	Dieback class[a] Current 0	1	2	3	4	5	Cumulative 0	1	2	3	4	5
Bracebridge District															
Macaulay[b]	35	5	1984	69	21	4	0	0	6	2	44	34	11	3	6
			1985	71	17	3	2	1	6	2	39	36	12	5	6
			1986	79	11	0	2	0	8	5	48	32	8	2	8
			1987	22	45	22	3	0	8	2	41	37	10	2	8
Pembroke District															
Alice[c]	18	4	1984	51	46	0	0	0	3	0	0	41	54	2	3
			1985	95	1	1	0	0	3	0	0	41	54	2	3
			1986	96	1	0	0	0	3	0	0	42	51	4	3
			1987	81	12	0	0	0	3	0	2	43	45	3	3
Wylie	25	3	1984	72	25	0	0	0	3	0	0	27	66	4	3
			1985	93	2	0	0	0	5	0	0	23	69	2	5
			1986	89	6	0	0	0	5	0	0	24	70	1	5
			1987	89	6	0	0	0	5	0	0	27	66	2	5

[a] Dieback classification: 0 = 0-5%, 1 = 6-20%, 2 = 21-40%, 3 = 41-60%, 4 = 61%+, 5 = dead tree.

[b] Forest tent caterpillar feeding resulted in 100% defoliation of the oaks on this plot.

[c] Only 96 host trees were tallied; four trees were cut down and removed.

ABIOTIC DAMAGE

Blowdown

Several severe thunderstorms, accompanied by high winds, resulted in blowdown at numerous locations in the central portion of the region. Single trees were uprooted and toppled along the Old Bobcaygeon Road in Minden Township and along the Hindon Access Road in Hindon Township, both in Minden District. Scattered, single-tree damage was also encountered at the northern end of Ridout Township in the Lake of Bays-Dorset area, Bracebridge District.

Two storms caused blowdown in 2- to 3-ha areas in Bracebridge District. The first occurred on 28 June in the town of Bracebridge. Numerous ornamentals and a small red pine plantation adjacent to a cemetery at the northern end of the town were uprooted in this storm. Single uprooted trees were seen for several hectares west of the town, along the path of the storm. The second storm, a tornado, hit the Torrance area of Wood Township on 24 July. This storm caused 2 to 3 ha of continuous blowdown, and numerous scattered, single trees were damaged across the northern end of Muskoka Lake.

Drought

The above-normal temperatures and below-normal precipitation in July of 1987 resulted in numerous, widely scattered areas of drought-damaged trees. The heaviest damage occurred on shallow, rocky-soil sites in the southwestern portion of the region. Scrub red oak and bur oak growing on the open rock exhibited drought symptoms by early August in Burleigh, Methuen, Anstruther and Chandos townships, Bancroft District, and in Harvey, Cavendish, Galway and Lutterworth townships, Minden District. This band of damage continued across the limestone plains in Laxton, Digby and Dalton townships in Minden District and westward onto the open granite in Muskoka and Wood townships in Bracebridge District and out to the Georgian Bay shoreline in Gibson, Freeman and Conger townships, Parry Sound District (Fig. 15).

Sugar maple stands, 20 to 30 ha in size, growing on ridge tops, were damaged in McLean and Ridout townships, Bracebridge District, in Hindon and Dysart townships, Minden District, and in Raglan Township, Pembroke District. White birch and trembling aspen growing on rocky sites at the northern end of Parry Sound District were also affected: 75% or more of the foliage had browned by early August. A 25-year-old 1-ha white spruce stand at PNFI that was row-thinned in July sustained 2% mortality that was attributed to the drought.

Additional data on the drought that occurred in July can be found under the heading Climatic Data and in Table 13.

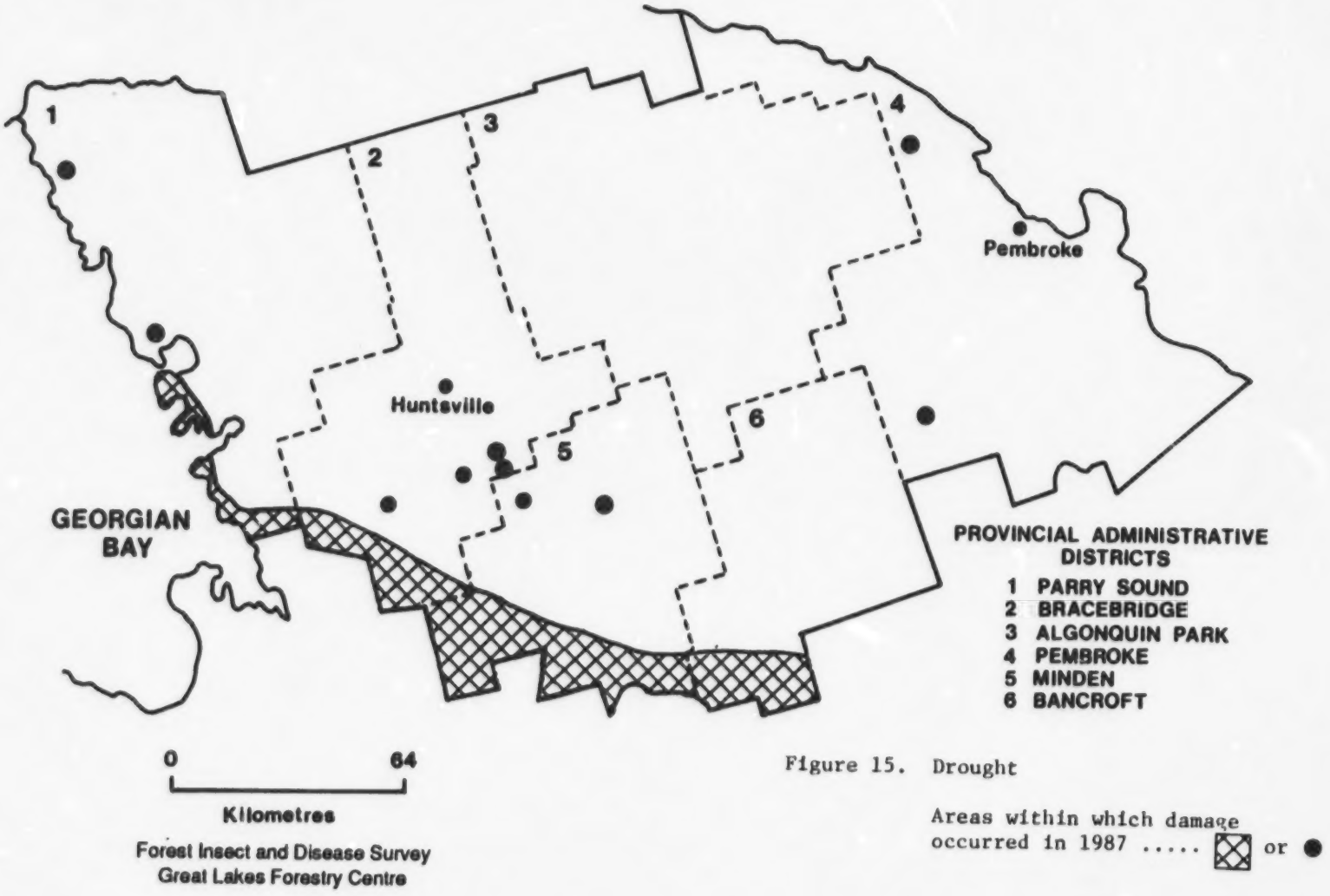


Figure 15. Drought

Areas within which damage occurred in 1987 ..... ⊠ or ●

Frost

After an unusually warm April in which temperatures reached the mid-20°C range, a cold spell occurred in the first week of May, with freezing temperatures recorded for four consecutive nights. The warm temperatures of April had flushed the buds on trees of many species across the region, and the new, succulent foliage was damaged or killed by the frost.

Young, open-grown white spruce was heavily damaged throughout the region. Virtually every white spruce examined sustained some level of damage; often more than 75% of the new shoots were destroyed. Quantitative data on damaged white spruce can be found under the heading White Spruce Plantation Survey.

Red oak and bur oak were also affected by frost. The problem on oak was compounded in some areas as a result of the current forest tent caterpillar infestation. The first buds were killed by frost and the adventitious buds were consumed by tent caterpillars. As a result, twig, branch and whole-tree mortality were in evidence at Gull Lake in Lutterworth Township and at Mountain Lake in Minden Township, Minden District, and along Hwy 11 in Macaulay Township and Hwy 35 in Franklin Township, Bracebridge District. Similar damage was seen along Hwy 69 in scattered pockets ranging from 2 to 5 ha in size in Gibson and Freeman townships, Parry Sound District. Damage in these pockets ranged from 5% twig mortality scattered throughout the crowns to as much as 50% mortality of the entire crown. Occasional dead trees were also observed in this area.

Hail

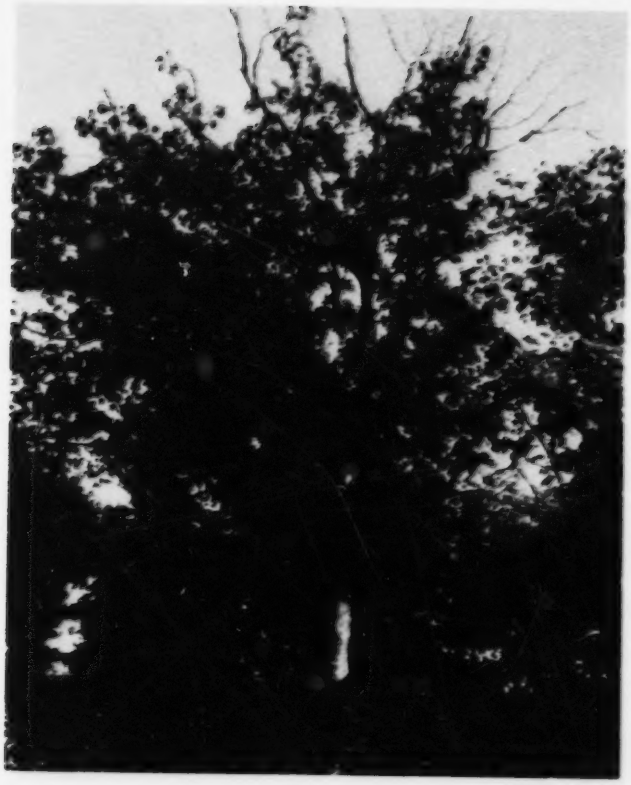
On 8 June, a severe thunderstorm deposited very large hail stones along a strip 45 km long and 3 km wide. Up to 95% defoliation occurred, primarily on poplar, from Wanda Lake in the southeastern corner of Barron Township east across Stratton and Master townships in Algonquin Park District. The damage continued across portions of McKay, Petawawa and Alice townships and the northeastern corner of Ross Township in Pembroke District.

The storm's path crossed mostly poplar stands but some large eastern white pine, red oak and maples were also damaged. Small branches were broken off the defoliated trees and there were extensive wounds on stems and larger branches. The extent of the damage will be monitored in 1988, for it may affect tree vigor.

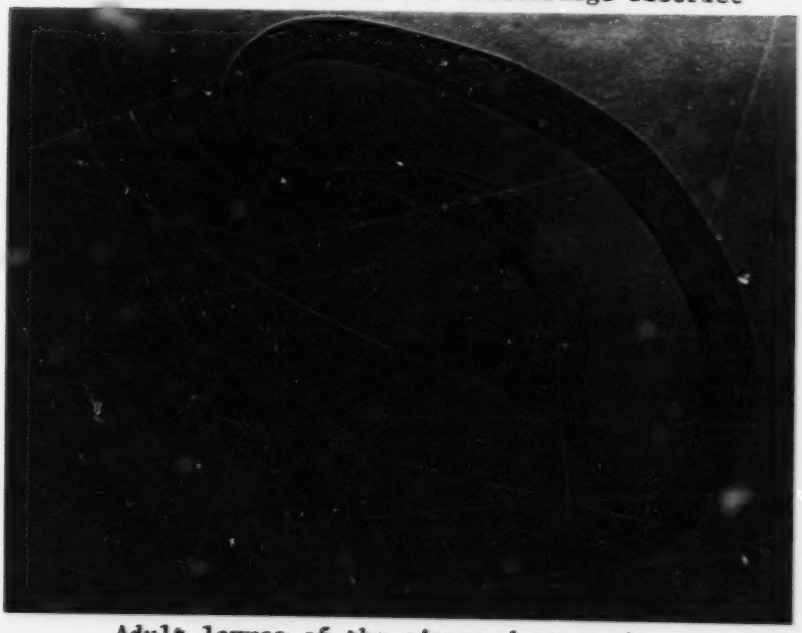
Winter Drying

Conifers with a southern exposure were very susceptible to this physiological drought condition in the spring of 1987. Damage levels varied greatly in many small pockets scattered across the Pembroke District and the eastern half of Algonquin Park and Bancroft districts. Foliage browning of up to 100% was recorded in an exposed portion of a small 3-m red pine plantation along Hwy 28 in Alice Township, Pembroke District. At two locations, one in Cardiff Township, Bancroft District, and the other in Gratton Township, Pembroke District, young eastern white pine planted for future seed orchards sustained up to 60% foliar damage.

At numerous locations ornamental conifers planted in exposed locations where they were susceptible to winter drying were severely damaged or killed.



Frost damage to the upper crown of a red oak (*Quercus rubra* L.) at the Forest Resource Centre in the Bracebridge District



Adult larvae of the pinewood nematode (*Bursaphelenchus xylophilus* [Steiner & Buhrer] Nickle) 600 x magnification

SPECIAL SURVEYS

Acid Rain National Early Warning System (ARNEWS)

In 1987 all trees on the six ARNEWS plots in the region were evaluated according to the prescribed ARNEWS evaluation techniques, which have been used since the plots were established in 1984. Each tree is rated for overall vigor, crown condition, current defoliation by any type of forest pest, symptoms of damage by acid rain, and woody tissue damage by forest pests. The three regeneration subplots at each plot were retallied and the established list of ground plants present on each plot was reviewed for any change in the type or quantity of plants. Soil samples were collected for analysis from each plot.

Defoliation of 10-20% by the forest tent caterpillar and Bruce spanworm was encountered at the Little Margaret Lake plot in Ridout Township, Bracebridge District, and at the Plastic Lake plot in Sherborne Township, Minden District. Approximately 10% defoliation by forest tent caterpillar was found in the Grundy Lake plot in Mowat Township, Parry Sound District, and 2% defoliation by the flat leaftier was found at the Coon Lake plot in Sproule Township, Algonquin Park District.

No damage or discoloration of foliage that might be attributed to the effects of acid rain was detected.

Beech Bark Disease, *Nectria coccinea* var. *faginata* Lohman, Watson and Ayres

A special survey was conducted in 10 hardwood stands with a high beech component for evidence of beech bark disease (Fig. 16). At each stand at least 25 host trees were examined for the characteristic fruiting bodies of the disease or the presence of the insect vector, beech scale (*Cryptococcus fagisuga* Linding.). No evidence of the disease or insect vector was detected in any of the 10 stands.

In Oakley Township in Bracebridge District and in Hindon Township in Minden District, two trees were found affected by a variety of hypoxylon stem canker. In Oakley Township *Hypoxylon fragiforme* (Pers.: Fr.) Kickx was identified, and *Hypoxylon deustum* (Hoffm.:Fr.) Grev. was identified from the sample taken in Hindon Township.

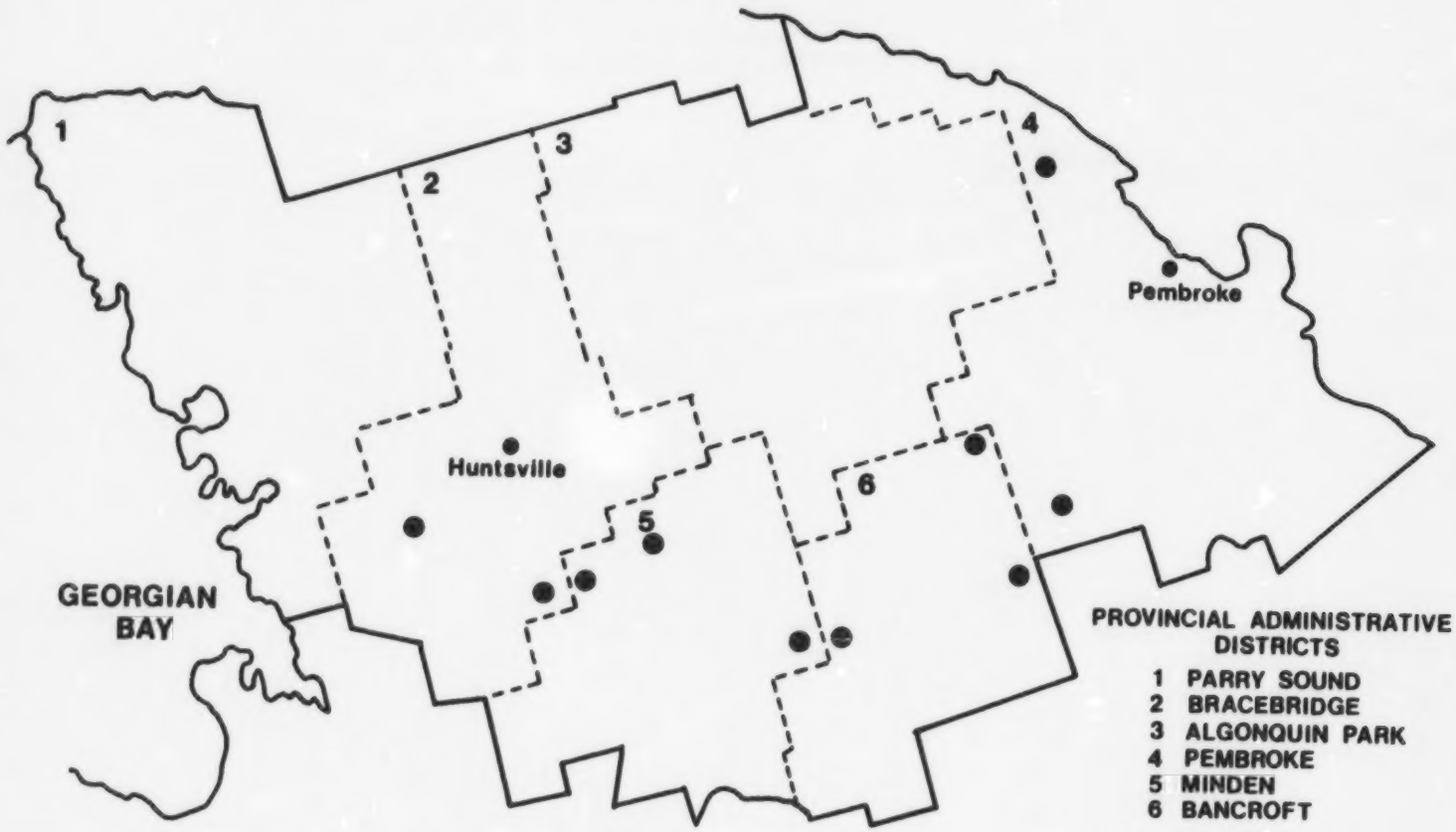


Figure 16. Beech Bark Disease (*Nectria coccinea* var. *faginata* Lohman, Watson and Ayers)

Areas examined for evidence of this disease in 1987 ..... ●

Pinewood Nematode, *Bursaphelenchus xylophilus* (Steiner & Buhrer) Nickle

Special surveys have been conducted in the region since 1985 in an attempt to detect the presence of the pinewood nematode and to determine the distribution of the pest. To date, 65 stands have been sampled: 26 red pine, 7 jack pine, 10 eastern white pine, 7 black spruce (*Picea mariana* [Mill.] B.S.P.), 2 white spruce and 13 balsam fir (*Abies balsamea* [L.] Mill.). Of these, 16 were confirmed to have some form of the pinewood nematode present in dead or dying trees. Pinewood nematode was identified in samples collected from a white spruce stand in Anstruther Township, Bancroft District, and from a black spruce stand in Perry Township, Bracebridge District. Positive identification was also made from balsam fir samples in Limerick Township, Bancroft District, and from Perry Township, Bracebridge District (Fig. 17).

The pinewood nematode has also been identified in samples collected from red pine plantations in Deacon Township, Algonquin Park District, in Mayo Township, Bancroft District, and in Horton and Buchanan townships, Pembroke District. This pest was also identified in eastern white pine samples collected in Stratton Township, Algonquin Park District, in Anson Township, Minden District, in Movat Township, Parry Sound District, and in Horton Township, Pembroke District. The nematode was also found in jack pine in Strattion Township, Algonquin Park District, Blair Township, Parry Sound District and Buchanan and Radcliffe townships, Pembroke District.

White Spruce Cone Survey

White spruce cones were collected from two locations in the region in an effort to evaluate the various pests that affect seed production. A natural stand was sampled northeast of the town of Maynooth in Wicklow Township, Bancroft District, and a second sample was taken from a plantation southwest of the town of Kinmount in Somerville Township, Minden District. At each location at least three trees were sampled and 100 current-year cones were collected. The cones were randomly selected from the total length of the conebearing crown.

In the Wicklow Township sample, 87% of the cones were damaged by insect activity. The seed count in sound cones averaged 67, and the seed loss in damaged cones averaged 36. The insects recovered and identified from this sample and listed according to the percentage of seed loss attributed to the insect are: the spruce cone maggot (*Lasiomma anthracina* [Czerny]), the spruce cone axis midge (*Dasineura rachiphaga* Tripp), the spruce cone gall midge (*Dasineura canadensis* Felt), and the spruce seed moth (*Cydia youngana* [Kearfott]).

In the Somerville Township collection 41% of the cones were damaged. The average seed count in the sound cones was 57, and the seed count was 39 in the damaged cones. The spruce cone maggot was the only insect recovered and identified; however, evidence of feeding by some other Lepidopterous insect was also found. It is possible that this damage was caused by the spruce coneworm *(Dioryctria reniculelloides* Mut. and Mun.).

White Spruce Plantation Survey

The annual survey of high-value plantations was conducted in 10 randomly selected white spruce plantations in 1987. A standard 150-tree evaluation was conducted at each location and a specific, predetermined list of insects and diseases was evaluated on two separate occasions, in mid-June and again in late July. Tables 12(a) and (b) summarize the data collected on the pests that were present at each location (Fig. 18).

During the first visit, the spruce bud moth *(Zeiraphera canadensis* Mut. & Free.) was found affecting 24.6% of the trees at five locations. The eastern spruce gall adelgid *(Adelges abietis* [L.]) was not part of the predetermined list of insects but it was encountered on 9.2% of the trees at five locations. On average, six chlorotic trees were found at each of seven locations, frost damage was found on 62.5% of the trees in eight of the plantations, and Armillaria root rot was detected in one stand, where it affected 1% of the trees. Pests not found during this visit were the spruce budworm, spruce coneworm, broom rust *(Chrysomyxa arctostaphyli* Dietel), and eastern dwarf mistletoe *(Arceuthobium pusillum* Peck).

During the second visit, it was found that the yellowheaded spruce sawfly *(Pikonema alaskensis* [Roh.]) had caused an average of 7.7% defoliation on 18% of the trees in three plantations and the white pine weevil *(Pissodes strobi* [Peck]) had attacked an average of 4% of the leaders in two plantations. The total number of stand openings in each plantation was recorded (an average of 2.3 per site). Spruce needle rusts *(Chrysomyxa ledicola* [Peck] Lagerh. and *C. ledi* [Alb. & Schwein.] de Bary) were also evaluated. Only one plantation was affected: 1% of the trees had 1% of their foliage damaged. A pest not found during this visit was the spruce cone rust *(Chrysomyxa pirolata* [Körn] Winter).

White spruce plantations were evaluted in 1981 and 1984 and the data collected in 1987 on major pests that appeared on the previously established list were very similar to those collected during the two previous surveys. The only exceptions were the spruce budworm, which caused heavy damage in three plantations in 1981 and light damage in two plantations in 1984, but was not encountered at all in 1987. Spruce cone rust affected 1% of the cones in 1984, but was not found at all in 1981 or 1987. Frost damage was not evident in 1981, whereas two plantations were damaged in 1984 and eight in 1987.

Table 12(a). Summary of the results of a white spruce plantation survey conducted at 10 randomly selected locations in the Algonquin Region in 1987 (counts based on the examination of 150 trees at each location).

Location (Twp)	Estimated area of stand (ha)	Estimated no. of trees per ha	Avg ht of trees (m)	Spruce budmoth	Yellowheaded spruce sawfly		White pine weevil	Eastern spruce gall adelgid
				Infested trees (%)	Infested trees (%)	Avg defoliation per tree (%)	Infested leaders (%)	Infested trees (%)
Bancroft District								
Burleigh	3	2,100	2.3	45	6	3	0	3
Wicklow	2	2,500	7.6	7	0	0	0	15
Bracebridge District								
Macaulay	4	3,000	1.0	0	3	2	0	0
Minden District								
Digby	5	1,900	0.9	0	45	18	0	0
Somerville	3	1,700	18.0	0	0	0	0	0
Parry Sound District								
Monteith	2	2,100	5.5	1	0	0	1	0
Pembroke District								
Bromley	8	2,000	3.1	67	0	0	7	13
Horton	6	2,500	1.7	3	0	0	0	1
Fraser	2	2,000	0.9	0	0	0	0	0
Wylie	1	1,300	10.2	0	0	0	0	14

Table 12(b). Summary of the results of a white spruce plantation survey conducted at 10 randomly selected locations in the Algonquin Region in 1987 (counts based on the examination of 150 trees at each location).

Location (Twp)	Estimated area of stand (ha)	Estimated no. of trees per ha	Avg ht of trees (m)	No. of stand openings	No. of trees chlorotic	Needle rust		Frost		Armillaria root rot	Current mortality (%)
						Trees affected (%)	Avg defoliation (%)	Trees affected (%)	Avg defoliation (%)	Trees affected (%)	
Bancroft District											
Burleigh	3	2,100	2.3	0	6	0	0	73	2	0	0
Wicklow	2	2,500	7.6	0	3	1	1	3	2	0	6
Bracebridge District											
Macaulay	4	3,000	1.0	2	15	0	0	85	5	0	0
Minden District											
Digby	5	1,900	0.9	14	8	0	0	23	1	0	0
Somerville	3	1,700	18.0	5	2	0	0	0	0	1	1
Parry Sound District											
Monteith	2	2,100	5.5	2	3	0	0	100	5	0	0
Pembroke District											
Bromley	8	2,000	3.1	0	0	0	0	97	2	0	0
Horton	6	2,500	1.7	0	0	0	0	100	2	0	0
Fraser	2	2,000	0.9	0	6	0	0	19	2	0	0
Wylie	1	1,300	10.2	0	0	0	0	0	0	0	0

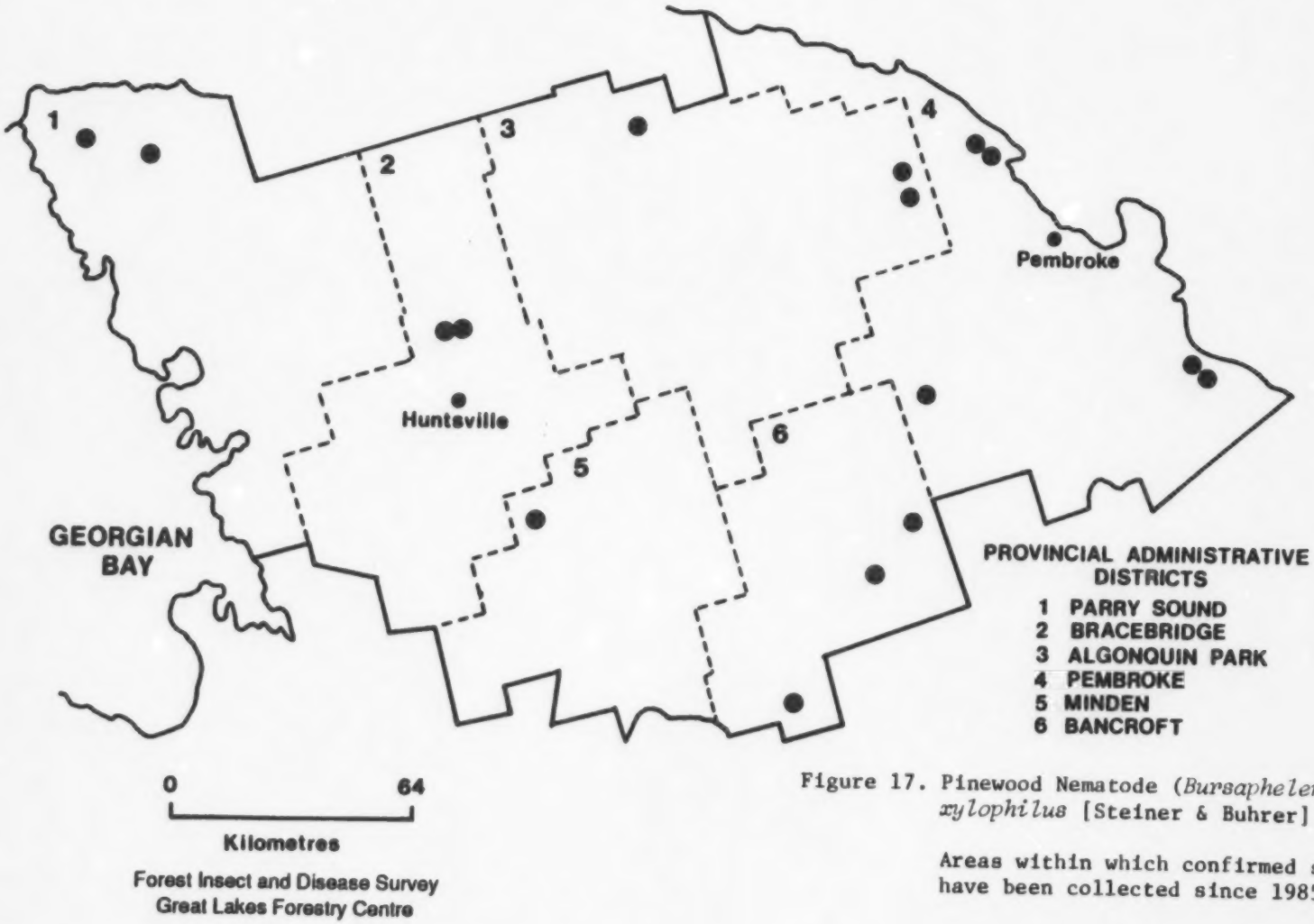


Figure 17. Pinewood Nematode (*Bursaphelenchus xylophilus* [Steiner & Buhrer] Nickle)

Areas within which confirmed samples have been collected since 1985 ....●

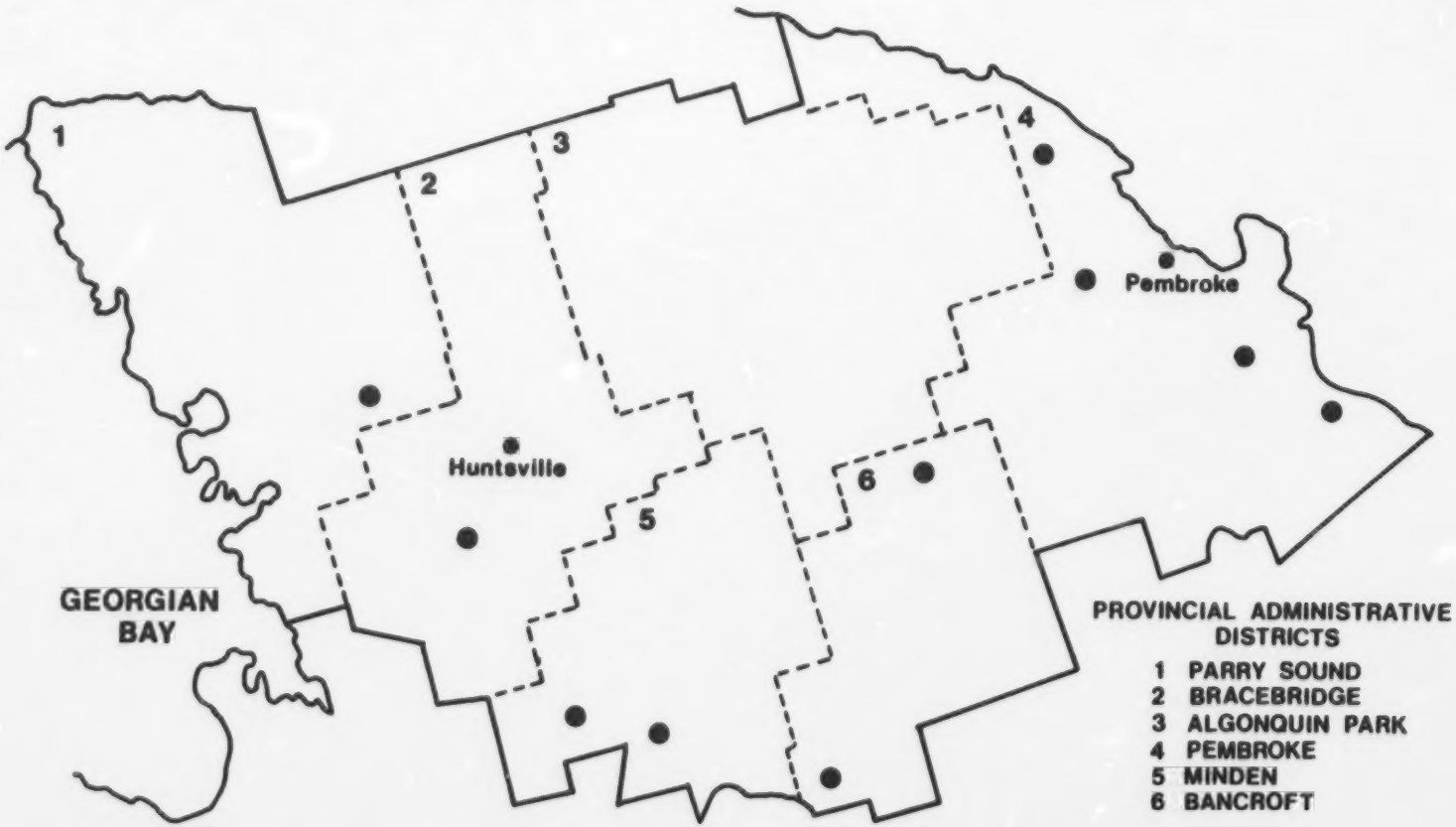


Figure 18. White Spruce Plantation Survey

Locations of plantations surveyed ....●

Light Trap

The annual operation of a light trap was conducted at PNFI in Pembroke District. The primary purpose of operating the light trap is to monitor the flight period and relative population levels of the adult spruce budworm, but the population levels of several other harmful insects are also monitored.

The light trap was operated every night from 20 June to 1 August. No spruce budworm moths were captured this year. Numbers of adult moths of the forest tent caterpillar increased dramatically, from 779 in 1986 to > 3,211 in 1987. A population explosion like this indicates a possible infestation in the immediate future for forests in the Chalk River area.

Climatic Data

Seasonal variations in the normal weather patterns have a direct effect on both biotic and abiotic conditions. Sudden and extreme changes in weather have, in the past, had a significant impact on pest problems, and in 1987 frost and drought damage affected the growth of trees of numerous species. Monitoring daily weather conditions also permits the accurate prediction of the emergence of overwintering larvae. For these reasons, the Forest Insect and Disease Survey Unit keeps daily and monthly averages of weather conditions on file for numerous locations across the province. Table 13 summarizes the weather data for 1987 (January to December). These data were provided by two Atmospheric Environment Service weather offices in the Algonquin Region. The normals quoted were taken directly from the Canadian Climate Normals for Ontario, 1951-1980.

Table 13. Summary of climatic data for the 12-month period, January to December 1987, from two locations in the Algonquin Region.

Location	Month	Mean temperature Actual (°C)	Mean temperature Normal (°C)	Total precipitation Actual (mm)	Total precipitation Normal (mm)
Bracebridge District					
Muskoka Airport	Jan.	-9.3	-10.4	44.6	85.9
	Feb.	-9.7	-9.4	25.8	62.4
	Mar.		-3.8		66.3
	Apr.	+8.3	+4.5	50.3	73.3
	May	+12.1	+10.9	86.5	77.8
	June	+16.9	+15.9	78.6	81.9
	July	+20.4	+18.3	62.3	77.5
	Aug.	+17.9	+17.4	67.8	89.0
	Sept.	+13.8	+13.2	48.0	102.4
	Oct.	+5.1	+7.5	108.9	93.9
	Nov.	-1.0	-1.1	63.7	101.0
	Dec.	-4.4	-7.1	112.5	97.8
Pembroke District					
Petawawa Weather Station	Jan.	-10.6	-12.8	39.3	46.7
	Feb.	-11.8	-11.2	33.4	51.0
	Mar.	-1.4	-4.6	80.3	50.5
	Apr.	+7.4	+4.2	40.4	59.6
	May	+11.6	+11.5	90.4	60.0
	June	+16.5	+16.3	60.9	87.5
	July	+20.3	+18.7	68.2	84.5
	Aug.	+16.9	+17.6	49.6	79.8
	Sept.	+13.9	+12.6	95.8	83.1
	Oct.	+4.7	+7.1	96.2	66.7
	Nov.	-1.7	-0.1	32.3	65.8
	Dec.	-6.6	-9.7	80.0	64.8